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Handbook of
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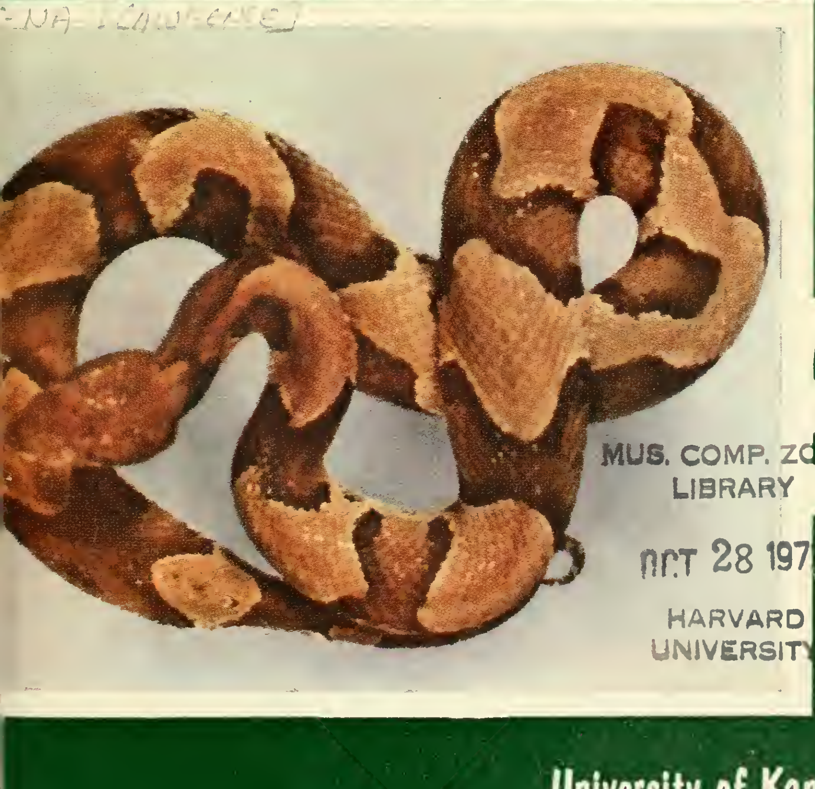
# of Kansas

by Hobart M. Smith



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2nd edition

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The HANDBOOK OF AMPHIBIANS AND REPTILES OF KANSAS by Hobart M. Smith results from a continuation of the work of the KANSAS BIOLOGICAL SURVEY; the Department of Zoölogy and Museum of Natural History of the University of Kansas from time to time hope to be able to provide in published form information on the kinds, distribution, habits, possible economic uses, and other attributes of the biota of the state. This second edition of the Handbook is a revision of the first edition and is published in response to scores of requests from citizens of Kansas for information concerning the amphibians and reptiles of the state.

E. Raymond Hall, *Editor.*

Snake in color on front of cover is a copperhead

HANDBOOK OF AMPHIBIANS AND REPTILES OF KANSAS

BY

HOBART M. SMITH

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PURPOSE

This handbook is designed to meet the needs of students and others who have little or no biological background but who are interested, either casually or seriously, in the identification, habits and distribution of the amphibians and reptiles of the state of Kansas. Little that is new is included in these pages. Advanced specialists in herpetology will find useful material chiefly, if at all, in the distributional data which have been carefully compiled as completely as possible from both published accounts and previously unreported specimens.

All species and subspecies for which definite evidence of occurrence could be found in the state are included in the following accounts. Other species (and even subspecies) of probable but unverified occurrence are listed on page 320, and these are likewise incorporated in the keys to adults (not to eggs or larvae) for the convenience of those who may discover them.

This publication treats only species now existing in the state. Extinct kinds were summarized by Lane (1945, 1946). For recent additions see Galbreath (1948), Oelrich (1952, 1953, 1954) and Twente (1952).

MATERIALS

Specimens used in preparing this account are for the most part in the University of Kansas Museum of Natural History. Other collections examined are at Kansas State Teachers College at Emporia, Pittsburg State Teachers College, University of Illinois Museum of Natural History, and Ottawa University. Pertinent published accounts, especially those treating of Kansas, have also been used.

Descriptions are based on individuals from Kansas although the mentioned extremes of variation are derived from knowledge available for the subspecies as a whole, or for the species in instances where no geographic races have been named. Accounts of habits and habitats are derived from information obtained in different states.

TREATMENT OF SPECIES

Probably most users of this account will be interested primarily in knowing the species to which an animal belongs, since the species is the largest category of "kind" which satisfies the needs of identification. It seems to be unnecessarily confusing, for most beginners, to be confronted with the detail of subspecific identities. Accordingly attempt has been made throughout to emphasize the species. For advanced students and specialists who are interested in the subspecies there is a brief statement at the end of the account of each species, of the subspecies in Kansas, and, if more than one subspecies occurs in Kansas the distinguishing features of each are mentioned.

The simplification by deëmphasis of the subspecies, which is contrary to the usual practice in guides of this sort, is made possible by the fact that subspecies have geographic ranges which are complementary, not overlapping. Therefore identification of a specimen to species from a known locality automatically furnishes a clue as to the subspecies concerned. Specimens from areas intermediate between the known geographic ranges of two subspecies of a single species are at best decipherable by only the specialist, to whom they should be made available.

MAPS

The account of each species is accompanied by two maps. One is a small map of North America, showing the range of the species as a whole, including all its subspecies, if any are known. The second map is an outline of the state, showing exact localities of known occurrence (see symbols) and the presumed range (a "shaded" area). The estimate of the range of any species in Kansas is based on (1) the locality records for that species, (2) physiography, and (3) distributional data for other species of similar range.

The symbols for locality records are as follows: circles, specimens examined; triangles, specimens reported but not examined; solid symbols, precise localities; hollow symbols, localities known only to county. Although most localities of occurrence have been recorded, not every one is recorded in every county. Closely grouped localities have been indicated by a single symbol in order to avoid undue crowding of symbols. However, at least one record is shown for every county from which the species concerned is known.

ACKNOWLEDGMENTS

Many associates have contributed to the completion of this work directly and indirectly, and to all I acknowledge my debt and express my gratitude. Among those to whom I am especially indebted are: Dr. Edward H. Taylor, who has provided numerous photographs; Dr. John C. Breukelman, for permission to examine the collection at Emporia State Teachers College; the late Dr. Henry

H. Hall, for permission to examine the collection at Pittsburg State Teachers College; the late Dr. William B. Wilson, for permission to examine the collection formerly at Ottawa University (now at the University of Kansas); Mr. Lester J. Short, Jr., for records of *Opheodrys vernalis;* Mr. R. F. Clarke and Dr. Richard B. Loomis, for numerous suggestions and corrections, and for use of numerous distributional records personally compiled; Mr. Roger Conant, Mr. Ray R. Hamm, Dr. Howard K. Gloyd, Dr. Sherman C. Bishop, and the staff at the New York Zoölogical Society for their coöperation and courtesy in making certain photographs available; Dr. Philip W. Smith, for suggestions and photographs; to Dr. Louis W. Ramsey, Dr. Anna A. Wright, Dr. Arthur H. Wright, Mr. Charles A. McLaughlin and Dr. Charles H. Lowe, Jr., for numerous photographs. Grateful acknowledgment is made to the Comstock Publishing Company, Inc., for permission to reproduce selected illustrations from my "Handbook of Lizards . . ." published in 1946. The drawings have been made by students at the University of Kansas, by Mrs. Katherine H. Paul, staff artist at the University of Illinois, and by Mrs. Virginia Unruh, formerly staff artist, University of Kansas Museum of Natural History, who has helped in other ways. Finally I acknowledge with gratitude the assistance of Dr. E. Raymond Hall, at whose suggestion the work was undertaken, and who has given critical editorial assistance to the several stages of the work and who has otherwise forwarded completion of the handbook.

HISTORY

Although Kansas is the birthplace and home of a relatively large number of herpetologists, none of them has published a thorough account of all of the reptiles and amphibians of the state. The nearest approach, but little more than a list of species, is Cragin's "A Preliminary Catalogue . . ." of 1881, in which eighty-eight species and subspecies are listed, although subsequently many of these have been shown not to occur in the state. A few supplementary papers by Cragin (1885, 1894) added some species to the list for Kansas.

The "father" of Kansan herpetology was unquestionably Dr. Edward Hallowell, who in 1856 reported upon a very commendable collection of twenty-four species and subspecies obtained by Dr. W. A. Hammond from "Kansas" (without further data, at a time when "Kansas" included a much larger area than it does now).

More recent accounts have treated restricted groups. Examples are: Branson's "The Snakes of Kansas" (1904), a rare item, now of little practical use since the nomenclature has been much changed in later years. Of still more recent date, and more nearly complete, are E. H. Taylor's (1929) list of the snakes of Kansas and C. E. Burt's paper on the lizards (1928). No more recent summary of either of these groups has appeared. The same is true of the only summary of the amphibians of the state which appeared in 1934, in "The Amphibians of Kansas," by H. M. Smith. All of the articles mentioned are unobtainable now except as secondhand items.

Despite the lack of a complete herpetological account, published records for the state are unusually numerous. Considerable field activity since 1925, in great part stimulated by Edward H. Taylor, Howard K. Gloyd, and Charles E. Burt, resulted in many accounts being published. Material from the state is contained in widely separated collections and has been reported in numerous monographs on natural groups which enter the state, as for example in Blanchard's *Lampropeltis* (1921) monograph, Taylor's *Eumeces* (1935) monograph, Gloyd's rattlesnake (1940) monograph, and in many others. Many of these, but by no means all, are cited in the appended list of literature.

Throughout this period of active collecting in Kansas, the role of the Museum of Natural History at the University of Kansas has been of great importance. A survey of the vertebrates of the state, initiated by Mr. C. D. Bunker of that Museum, gave the initial impetus to the field work that has made the distribution of the fauna of this state relatively well known.

COMPOSITION OF FAUNA

At the present time 98 species, or a total of 110 species and subspecies, are known from Kansas. At least 13 others are to be expected and undoubtedly still more will be found. The totals are as follows:

NUMERICAL DISTRIBUTION OF THE HERPETOFAUNA OF KANSAS

	Species verified	Species and subspecies verified	Probable but unverified species and subspecies
Salamanders	9	10	2
Anurans	20	24	3
Lizards	15	16	1
Snakes	40	46	3
Turtles	13	13	2
	97	109	11

Although intensive field work has been carried on for many years in the state, much yet remains to be learned of the composition and distribution of the fauna, especially along the borders of the state.

A comprehensive list of the fauna in only one other adjacent state (Nebraska) has been published in recent years; for it Hudson (1942) estimated 56 species and subspecies at that time. Although now far out of date in nomenclature and completeness of distributional data, summaries are available also for the states of Missouri (Hurter, 1911) and Colorado (Ellis and Henderson, 1913, 1915). No complete printed summary has appeared for Oklahoma, except for a list of species and localities which Ortenburger published in 1926. The same author published a key to the reptiles only a few years later (1930), and Bragg *et al.* (1950) have summarized the amphibians (others of partially synoptic scope are Bragg, 1942, 1943a, b, 1944a, 1945; Bragg and Smith, 1943). For certain other nonadjacent states lists of the fauna have been prepared, although a good many years ago, and some of the compilations can now be considered far from accurate.

Comparisons of the Kansan Herpetofauna with That of Other States

Washington	25	(1942)	New Mexico	88	(1924)
South Dakota	36	(1943)	Missouri	102	(1911)
New Hampshire	36	(1939)	Kansas	109	(1954)
Idaho	40	(1941)	Illinois	110	(1949)†
Minnesota	45	(1944)	Oklahoma	127	(1934)†
Michigan	46	(1928)	Arkansas	130	(1938)
Nebraska	56	(1942)	South Carolina	142	(1954)
Colorado	57	(1915)	North Carolina	145	(1943)
Utah	57	(1931)	Florida	162	(1940)
Oregon	63	(1939)	California	169	(1947)†
West Virginia	70	(1934)	Alabama	180	(1954)
Pennsylvania	74	(1939)	Texas	216	(1947)
Ohio	78	(1935, 1943, 1946)*			

For what it may be worth, however, the number of species and subspecies recorded for each of these states is listed herewith. All lists published prior to 1940 now are subject to extensive revision (especially in the case of New Mexico, but less so in the case of more eastern states such as Florida, Michigan, Pennsylvania and West Virginia). More recent lists require fewer corrections, but none is complete. The table reveals that the most important factor in providing a large faunal list for any state is its latitudinal position: there is a gradual and steady increase in number of kinds toward the south along any meridian.

The second most important factor is an east-to-west geographic position which embraces good representations of each of the major groups of reptiles and amphibians: along any parallel their number increases as approach is made from either the west or east to the area which lies between the Mississippi Valley and the Great Plains. Texas exceeds any other state in extent of its herpetofauna; Arkansas exceeds any other in its parallel (except perhaps Oklahoma or North Carolina); Missouri exceeds any other in its parallel; and no doubt Iowa and Wisconsin hold the honor in their positions.

---

* The dates refer to reptile, salamander and anuran synopses, respectively.

† Unpublished estimate.

Finally, however, the table reveals the futility of the use of states or other political divisions for comparisons of faunae on natural grounds. Some states include a highly varied topography or climate; they may be expected to have—and actually do possess—a more varied fauna than states in which conditions are more uniform.

VENOMOUS SPECIES

No lizards, turtles or amphibians in Kansas are venomous. All statements to the contrary are erroneous. The only possible grain of truth in the accusation that any of these are venomous is the fact that the secretions of the skin of some salamanders, toads and frogs are toxic when taken into the digestive tract or rubbed onto the nasal membranes or into the eyes of mammals. Even this toxicity, in species of Kansas, is relatively slight so far as man is concerned. Perhaps there should also be mentioned in this connection the temporary infusion of the poisonous muscarine of deadly mushrooms into the tissues of box turtles that have eaten these plants, with secondary poisoning of persons who eat the turtles (see discussion, p. 140).

The only truly venomous reptiles in the state are certain members of the family of pit vipers—the copperhead, cottonmouth, and rattlesnakes. All of these can be recognized unequivocally by either (1) the presence of a large pit on either side of the head in front of the eye, in addition to the pair of small nostrils near the tip of the snout; or by (2) the presence of a pair of large, movable fangs at the front of the mouth. Persons who are bitten should make a determined effort to learn whether the snake is a deadly one or not. Much undue anxiety and pain could be avoided by definite identification of the kind of snake concerned.

A summary of first aid and precautions for snake bite treatment is given on p. 302. For further information on the subject of venomous snakes and their structure, see Schmidt and Davis (1941).

COLLECTING

There are many techniques for discovery of specimens of reptiles and amphibians. Each collector develops his own methods to a greater or lesser extent, and often becomes proficient in one or more techniques. Certain more or less basic principles are universal, however, among successful collectors.

At certain times of the year, especially in spring, much success can be obtained by slowly driving along highways at night, with careful scrutiny of the area of the road lighted by the headlights. With experience, even the tiny blind snakes (*Leptotyphlops*) can be discerned by this means, and of course all manner of other snakes and of amphibians may be found. By this means diurnal and aquatic species such as lizards and some snakes are never or rarely found. Success varies with the speed of driving, alertness of the observers, intensity of the lights, nature of the road, darkness of the night, temperature of the air, temperature of the ground, humidity, and the type of country on either side of the road. Careful observations on the correlation of these factors with abundance of animals discovered are much to be desired.

Many amphibians are most easily discovered at night, when they are breeding or prowling for food. Use of a headlight or, still better, a gasoline lantern is highly recommended as an aid in collecting them. In spring, choruses of frogs will lead to their discovery; at such times it is profitable simply to drive about until voices of interest are heard. At other times any pond, marsh or other body of water may be expected to yield specimens. Salamanders of most species breed early, even while a thin layer of ice still is present on the water. In western Kansas, specimens of the tiger salamander (*Ambystoma tigrinum*) have been found not infrequently at the mouths of burrows of mammals in which the salamanders spend the day but from which they may wander a short distance at night. All caves, especially those with any water in them, are likely places for amphibians and to a lesser extent for reptiles as well. In caves, care should be taken to observe streams or pools closely for any sign of small, often white, salamanders.

Lanterns are likewise valuable when observing nocturnal snakes on flat plains, desert flats and along streams. On the plains one should become accustomed to watch both far ahead for fleeting glimpses of wary snakes, and near at hand for the motionless bodies of sluggish or temporarily blinded species. Along streams snakes often do not move even when closely approached; at other times they dive quickly and must be hastily captured if at all.

Another productive practice is the seining of marshes, ponds and streams. Turtles and occasionally snakes or salamanders are to be found by this means. It is well, if any closely packed debris or vegetation is present near the borders of the bodies of water, to haul quantities of such material onto the shore and carefully pick through it for salamanders, frogs, snakes or turtles. This procedure is often extremely effective.

Of most universal application, of course, is the technique of keeping a sharp eye on the entire surroundings, and of turning every conceivable type of cover. Stones, logs, cardboard, junk, tin, and any other movable surface cover may well conceal some desired reptile or amphibian, even in streams. A good collector, literally and figuratively, never leaves a stone unturned. In early spring especially, and in the fall, one may expect good results from this effort. In the summer the ground under such cover is often too dry, and little will be found. At such times of the year it is by far the best practice to hunt early in the morning, before the heat of the sun has penetrated through cover to the ground. Often much more will be present under such cover early in the morning than at any other time.

In certain areas removal of debris from the ground reveals many specimens. Accumulations of leaves, twigs, and even flood deposits, often conceal reptiles or amphibians. Rotten logs, and loose bark on logs or trees, likewise are a favorite haunt; different species often prefer different types of logs. As logs are turned and broken up one should always remember to turn the bark that often still lies on the ground, half covered with particles of rotten wood, and under which animals often seek protection. Piles of hay drying in fields often conceal many snakes, and make it profitable for the collector to be present when the hay is being removed.

Turtles may often be found by watching the edge of streams or pools for small holes in the mud or sand through which the heads of turtles may have been projected. Feeling with the hands or feet about such spots often yields turtles that are difficult to find otherwise.

Once discovered, all frogs and salamanders occurring in Kansas may be captured and handled with impunity, for they do not bite or otherwise injure persons. Care should be taken, however, to avoid any possible entry of the secretion into the collector's eyes, nose or mouth, for the skin exudate of some salamanders, some frogs (for example, *Rana palustris*), and all toads is poisonous if ingested and irritating on any mucous membrane.

No lizard in the state is venomous, but all can bite; therefore some precaution may be desired. Actually, only the collared lizard (*Crotaphytus collaris*) and sonoran skink (*Eumeces obsoletus*) have jaws powerful enough to deliver bites painful to persons. All others have jaws so small that no precaution need be made to avoid their bite. The horned lizards are reluctant to bite, although they do have a peculiar protective device of squirting blood from their eyes upon occasion when seriously alarmed.

Snakes, on the other hand, include a number of highly dangerous, venomous species. Unless these can positively be recognized in advance, the amateur should treat all snakes as if venomous—that is, avoid them or capture them in the safest possible manner. Wanton destruction of snakes or other reptiles is much to be deplored, for all are of very considerable value in the balance of nature and to man in controlling his really important enemies and pests among the insects and small mammals. It is indeed unfortunate that man has not appreciated generally the beneficial role of practically all reptiles.

Harmless snakes can be captured by picking them up quickly by any part of the body. It is true, however, that any snake more than sixteen inches long may be capable of giving a painful bite, and that therefore some precaution against them may be desired. Gloves may be used, or a stick or other object may be used firmly to hold the head, while the other hand grasps the snake immediately behind the head or even at the very rear of the head.

Venomous snakes may similarly be captured, but great care should be used to avoid the fangs, and to hold the rear of the head firmly enough so that it is impossible for the snake to twist the jaws about and wound a finger with the exceedingly mobile fangs.

Fast-moving, wary lizards and snakes can be obtained by means of .22 caliber shells loaded with fine shot (".22 long rifle shot shells"). Lizards are usually killed by the shot, but snakes often are only stunned long enough to allow their apprehension. Care should be taken not to shoot from too close a range, since the specimen may be so damaged as to be useless. The less an animal is mutilated the more valuable it will be as a specimen.

Some collectors use a noose on a long stick to capture venomous or vicious snakes. The forked stick, widely known, is of doubtful value unless the arms of the fork are made very short, so that they do not obstruct a firm grip on the neck by the crotch of the fork.

CARE OF LIVE INDIVIDUALS

In the field, live specimens are ordinarily placed in specially constructed, double-sewed, unbleached muslin bags of various sizes ranging from that of a ten-pound sugar sack to that of a 100-pound flour bag. Sugar sacks and flour bags can be used, but if so a certain loss should be expected, for neither the cloth nor the sewing is strong enough to hold all animals safely. A string for tying around the neck of the bag two or more inches from the mouth should be attached by its middle to one seam.

Two of the animals most often kept alive in houses and schools are common frogs (*Rana*) and the anole (*Anolis*, or, improperly, the "chameleon"). Suggestions for the care of the latter are given in the discussion of that species (p. 170); these could well apply to many other lizards. Dr. S. Meryl Rose, of the Department of Zoology, University of Illinois, has suggested, in Ward's Natural Science Bulletin (Vol. 20, No. 3, p. 45, 1947), an effective means for keeping frogs alive. His article follows:

"When one begins to keep frogs in a laboratory the question of an adequate artificial diet soon arises, because the time and space required to grow natural food for a large colony of frogs precludes it as a practical venture in most laboratories. In the last few years we have experimented with a number of simple artificial diets and have finally fixed on one which maintains rapid growth. It is a mixture of mammalian or fish muscle, bone meal and cod-liver oil. The meat is cut into thin strips and rolled in bone meal made sticky with cod-liver oil. This mixture tempts few frogs to jump for it, but there are exceptions, all bullfrogs. The usual practice is to open the frog's mouth with smooth, blunt forceps, and then, while holding the mouth open by a thumb inserted near the angle of the jaw, to push in enough meat to fill the posterior two-thirds of the mouth cavity. If the mouth is then closed and the frog made to sit out of water, the food is swallowed. Young frogs fed this amount every other day and kept between 20° and 25° C. grow well.

"The cod-liver oil was added because growing laboratory frogs, deprived of sunlight and without an added source of vitamin D, rapidly develop rickets. Associated with the rickets are periodic seizures with universal muscle contractions resembling a reaction to strychnine. Compound fractures of rachitic femurs are common during seizures and a frog survives only a few seizures. However, by adding a source of vitamin D to the diet some frogs have been made to recover even after two seizures and a compound fracture of one leg, and have been kept another year in the laboratory in healthy condition. The bone meal was added to the diet because abnormal skeletal proportions were observed in rapidly growing frogs. Since the addition of bone meal three years ago all of our growing frogs have had normal proportions.

"Disease epidemics sweep through colonies of captive frogs with alarming rapidity and thoroughness. The common practice is to call almost all of these diseases 'red-leg.' Our observations, quite incidental to other studies, indicate that there are several different diseases, usually fatal, which are partially characterized by red spots on the legs and elsewhere. An alternative possibility is that red-leg, a disease condition in its own right, accompanies other diseases. One disease in particular, a kind of leprosy, has attracted our attention because it interferes with limb regeneration. Minute ulcers on the toes usually accompanied by red spots elsewhere are the first symptoms of the disease. The ulcers enlarge and the soft tissues of the toes regress leaving phalanges exposed. Regression of soft tissues with subsequent sloughing of skeletal parts may proceed until entire feet are lost, but far more commonly, the frogs die after only small parts of toes have disappeared. Accompanying the regression of tissues is loss of sensory function in the affected appendages while motor function is maintained.

"All of the common diseases of frogs are prevented by addition of 0.15 percent of NaCl to the tap water in which the animals are kept. As a rule we use oblong aquaria tipped up a few inches at one end and with enough saline solution added to cover about one-third of the floor. The rest of the floor is covered by moist paper toweling which extends down into the solution and acts as a wick. The solution is continuously aerated and is changed every day along with the paper.

"With the above methods of care, a dead frog has become a rarity in our laboratory."

Snakes may be kept in screened wooden cages on a bottom of wood shavings. Water should be made available at all times. See Allen and Neill (1954) for further suggestions for care of live reptiles.

PRESERVATION OF SPECIMENS

Proper preservation involves three steps: (1) killing; (2) hardening, and (3) tagging. The last step is the one most often omitted, unfortunately. Teachers and students are often misled into pride for a personal collection of local animals which, through lack of recorded data, is useless to an outsider who might otherwise join in their pride. Addition of simple and accurate locality data is a small task as compared with the other steps necessary for proper preservation, yet the importance of accurate labeling has been woefully underestimated. Anyone who preserves a specimen should resolutely make a record, in some fashion, of the locality at which the specimen was obtained, and record the date and name of the collector. These data should be attached to the specimen.

The simplest and perhaps best way to kill reptiles and amphibians is to immerse them in weak alcohol of not more than fifty-five percent dilution. They should be removed as soon as dead in order to avoid stiffening in awkward positions; this is especially important for amphibians, since they quickly become rigid. Ether can be used, but chloroform never, since it causes the animal to die with its muscles taut. Hot water also produces the same reaction in frogs. It is essential to use some means for killing that leaves the animals relaxed.

Next, for amphibians, place the animals in a tray. Spread the toes and fingers in a lifelike position and pour over them a mixture of one part of formalin to five parts of water. Pour on no more than enough to cover the bottom of the pan, else the toes and legs may float free and change their position. Allow to harden for fifteen minutes, then pour on more, enough to cover the limbs. Allow to remain for one hour, or until moderately stiff, then drop into a jar containing a solution of one part of formalin to six parts of water. They should there float free so as not to be distorted by pressure of other specimens; avoid crowding. After they have become thoroughly hardened (usually in two to three days) they should be removed. Tags recording the locality and other data should be attached at or before this time. At this time a small slit should be made in the abdomen with a razor blade or pair of sharp-pointed scissors, or, instead, the specimen may be injected with a one-to-six solution of preserving fluid. In thus injecting specimens, care should be taken to avoid unnaturally distending them because this obliterates many of the important diagnostic characters. The specimens should then be stored in sixty-five to seventy percent alcohol. Amphibians should *never* be placed in alcohol stronger than seventy percent, since shrinkage of the skin and digits—both of which carry very important characters—often results.

Lizards can be treated like amphibians with a few exceptions. The belly should be cut long and deeply, and the tail should be slit at various places along its length and always toward the base (or if small, should be pierced by a needle) before spreading. The operation on the tail is very important, although frequently omitted. In spreading long-tailed species, the tail should be brought forward along the body for protection and may even be *loosely* tied in position. The fluid may be poured fairly deeply over them, care being taken not to float any part of them free until they are hardened. Lizards require a longer time for the initial hardening than do amphibians; reptiles should be left twelve to eighteen hours. Transferred to the jar for thorough hardening, they should remain for approximately a week, at which time they may be stored in seventy-five percent alcohol. They should not under any circumstance be placed in a solution weaker than seventy percent. Note that this is stronger than the requirement for amphibians.

Snakes should be treated like lizards, with two exceptions. They may either be coiled flat in the tray with the head at the center of and resting upon the nearest coil, or they may be coiled springlike in a jar of appropriate size. In the latter position they need not be removed until thoroughly hardened; if in the former position they should remain only until fairly stiff, and then be removed to jars where they can harden completely. Large snakes are more appropriately spring-coiled and small snakes flat-coiled. As a precaution, the viscera can be removed from large snakes. These eviscerated specimens can be placed upside down in jars so that air pockets do not prevent thorough exposure of all parts to the formalin. The tail must be slit, as in lizards.

Turtles should, preferably, be injected with formalin (1 to 5 or stronger). If this is not convenient, the skin between the arms and neck, and between the legs and bridge, on both sides, should be slit with a knife and the knife worked around deep in the body in order to effect a means of entry for the formalin. The mouth should be propped wide open with a cork, stone, stick or other object. This is of extreme importance. Then the specimen should be immersed in formalin and the legs and neck stretched out as much as possible. Avoid allowing the head and limbs to withdraw, since it is next to impossible to extend them once they are hardened. Turtles may be left permanently in formalin.

For tagging of the specimens, some water-resistant paper, preferably as furnished by biological supply houses, or as available at most laundries, should be used. The tag should be strung, and on it should be written, in pencil or in Higgin's Eternal Ink (not India Ink nor any other type) the date and locality of collection, and name of the collector. If the locality is unkown, merely say so. This satisfies the demands of anyone who wishes to know. The experienced collector assigns also a number, and in a field catalog keeps opposite the number, the data mentioned and identity of the specimen. The plan of attaching to the specimen a tag with only the number, which refers to a catalog in which the data are kept, is obviously hazardous since the value of the specimen depends entirely upon the catalog, which might easily be lost or destroyed.

It is important to check the fluids in containers as least twice a year, or oftener in a hot, dry climate, in order that they do not become exhausted. The collection should be stored in the dark, or where only artificial light can reach it, since daylight rapidly fades specimens.

Two stages of amphibians have been relatively neglected, and deserve much more attention than they have received in the past. These are the tadpole and egg stages of anurans. Orton (1946) remarks as follows concerning tadpoles:

"The larval stage of the Amphibia has long been one of the comparatively unexplored fields of vertebrate zoölogy. Much work is needed to make this section of the fauna known to interested students and investigators. Larval stages of less than one-third of the frogs of the world have been described. Even the tadpoles of many of the frogs in the United States, particularly in the western half of the country, are incompletely described or entirely unknown. Descriptive and morphological studies are necessary preliminaries to the preparation of identification keys. Ready means of identification are, in turn, essential if effective utilization of the animals in experimental work is expected. . . .

"If tadpoles are present in a collecting site at all, they are usually sufficiently abundant to permit the collection of series. This is fortunate, for only through the study of series can the characters and limits of variation be determined. The modern concept of species in terms of populations rather than individual specimens applies to larval as well as adult stages.

"Preservation of fresh specimens in the field is preferred, both to forestall the very rapid degenerative changes in the soft parts and to prevent shedding of the beaks and labial teeth. Fixation in ten percent formalin is recommended. For permanent storage, the specimens should be transferred to seventy percent alcohol if possible. Full locality data and brief notes on the habitat should be recorded. Notes on the color and pattern in life are desirable. Many tadpoles have conspicuous markings of red or yellow, areas of metallic iridescence, or other color characters that disappear more or less completely in preservative. Such ephemeral pattern elements as these are of little assistance in the identification of preserved material, but they are often highly diagnostic of the living specimens and should be adequately described.

"Preserved tadpoles are somewhat more difficult to ship than are the adult states, for they require more careful packing to prevent drying or crushing. Small specimens should be placed in tightly corked vials filled with formalin or alcohol, each vial wrapped in cotton, Spanish moss, shredded paper, or other soft material, and then wrapped and tied in a small piece of cloth to hold the packing together. A slip bearing the data should, of course, be placed with each lot of specimens. The wrapped vials may then be placed in excelsior in a small box in such a way that the vials are not in contact. Preserved tadpoles too large to fit standard-size vials may be wrapped in formalin-soaked cheesecloth or cotton, placed in a small bottle with sufficient preservative to keep them wet, and the bottle packed carefully to prevent breakage."

A recent study of eggs of anurans of this country, by Livezey and Wright (1947), should furnish an impetus to the study of this highly interesting stage of life history. They summarize as follows:

"Much in the way of adequate field descriptions is lacking in the study of the eggs of frogs and toads in this country. Seldom are there complete notes published on the appearance of the masses in the field. It is surprising to find that that phase of the life history receives no more attention than it does at present, nor has in the past, with herpetologists. Some of the field data that would aid greatly in the future study of this subject are suggested as follows: location, date, place of deposition (margins or centers of ponds), appearance of mass (globular, plinth, irregular, etc.), how attached and to what, depth of mass, depth of water, type of pond or stream (stagnant, fresh, slowflowing, swift, clear, muddy, rocky, sandy bottom), vegetation in the water and on the bank, air temperature, water temperature, other amphibians or their eggs, state of development at time of collection, and pigmentation. Data that could be completed at a somewhat later time in the laboratory are: volume of mass, volume of individual eggs, number of eggs per mass, complement per frog, number of envelopes, diameter of vitellus, vitelline capsule and all subsequent gelatinous envelopes.

"Another failure in the study of eggs of Salientia of this country is the laxness in collecting specimens from various localities throughout the animal's range. A much clearer concept of the optimum appearance and condition of deposition could be gained by further collecting. After a description appears in print, most workers seem satisfied to take that description without additional investigation. Hence, sooner or later a difficulty arises, as in the case of *Pseudacris nigrita triseriata,* where two almost totally different descriptions are given for the one form. Such as this may also arise by failure to use care in the collecting, preserving, and identification of the eggs. A sampling over wide areas may very possibly give further data relevant to the geographical variation of these animals and shed some light on the validity of some of the species and subspecies that have been considered by the taxonomists.

"So far as this writer has been able to determine, by questionnaire, there are at present no collections of Salientian eggs of any size or completeness in existence in this country. Even the commonest forms have not been kept to provide a reference for future use. The only depository of any size is at Cornell University, and sorry to say, that collection has been harmed in recent years by breakage of a steam line in the place of storage and through the addition of alcohol to several specimens in the process of replenishing the preservative. In other words, this aspect of the study is practically nil.

"Perhaps the best method of preserving amphibian eggs is first to put them in ten percent formalin for not more than twenty-four hours. After this time has elapsed, they should be removed to a four percent solution of formalin for permanent storage. The use of alcohol is decidedly detrimental to the muco-protein forming the jelly envelopes and will dissolve it away in a short time. When collecting both the eggs and the adults of these animals, it is often the habit to attempt to preserve both in the same container, and as a result the eggs are soon rendered valueless by the alcohol most often used for the preservation of the mature animals.

"The only sure method of identifying many of the eggs is to observe the female in the act of laying, and then collect both the adult and the eggs. In this event it should be remembered that the jelly of the eggs may take some time before it swells to normal size, fifteen minutes to twelve hours or more, and should be allowed to do so before being put into any preservative. Eggs laid in the laboratory often are not of normal appearance for usually they are deposited in glass containers without provision for attachment; and even if this is done many specimens will not deposit normally in the abnormal situation. Such masses will become flattened by the bottom and walls of the container and will fail to gain the natural shape and size.

"Along this line it might be well to point out that in collecting eggs, caution must be used not to overcrowd specimens of eggs or pack them with animals and other materials. Putting masses in cheesecloth is not recommended, for the jelly will adhere to the cloth and in unpacking the specimens will be damaged and distorted. The best method is to be provided with proper sized jars or tins, even though this may be bulky and at times cumbersome. In storing a collection, it is expedient not to place it in excessive heat or in sunlight, otherwise the jelly will deteriorate rapidly."

IDENTIFICATION

Sooner or later, once a specimen has been obtained, the question of its "kind" or identity arises. There are two names furnished for each species, in this handbook: the common (vernacular) name, and the scientific name. To determine the name, reference should be made first to the key to classes (unless the class is already known), then to the key to orders or suborders of the class to which the animal belongs, and then to the key to the species of that order or suborder. The last key will supply the scientific name, and the common name will be found by reference to the page number which follows the scientific name in the key.

The keys are made in the form of a number of sets of two opposing statements, and the sets are numbered consecutively. Beginning with set number 1 (1 and 1′) a decision should be made as to which statement applies to the animal in hand. The fitting statement either leads to a scientific name, or is followed by another set of opposing statements (2 and 2′) indented underneath it. One should continue in this fashion until a name is indicated for the animal or its class, order or suborder.

The common names are names applicable to the entire species, including all of its subspecies. The scientific name of a species is made up of two parts. The first part is the name of the genus and this generic name always is to be written with an initial capital letter. The second part is the name of the species and this specific name is to be written, in zoölogy, without an initial capital letter. For example, *Pseudacris nigrita* is the whole of the scientific name of the Striped Chorus Frog in which *Pseudacris* is the name of the genus and *nigrita* is the name of the species. At the head of each species account the author's name follows the scientific name; the author's own name is placed in parentheses if the generic part of the name is different from the one used by the author of the specific name. For instance, Le Conte is the author of the name *Pseudacris nigrita*, but in writing this name we place parentheses around the name of the author, Le Conte—*Pseudacris nigrita* (Le Conte)—because when

Le Conte originally proposed the name for this species he wrote "*Rana nigrita.*" Discovery that the species he named *nigrita* did not belong in the genus *Rana* but actually in the genus *Pseudacris* resulted in removal of the species from the genus *Rana;* and now, no matter in what genus the species is placed, other than *Rana,* Le Conte's name must remain in parentheses. If we put the specific name *nigrita* back in *Rana,* the parentheses would be removed from Le Conte.

As a person becomes more and more familiar with the kinds of reptiles and amphibians, it is well to pay some attention to the subspecies, which are *geographical* subdivisions of a species, based upon not only their occurrence in different areas but of course upon recognizably different features (as color, size, number of scales, etc.). Some species, while occurring over wide expanses of territory, show no features consistently in one area that do not occur in others, so no subspecies are recognized. In other species of similar distribution the animals in a number of areas may show distinctive features not occurring elsewhere in the range of the species. Some species contain dozens of subspecies. In Kansas, no more than two subspecies occur in any species of reptile or amphibian. The names of the subspecies, and their distinctive features if more than one occurs in the state, are cited at the end of the discussion of each species.

Further information upon many phases of herpetology (in other words the study of reptiles and amphibians) can be found in the articles cited in the list of literature (p. 330). The best summaries now available, covering the entire field of herpetology in North America, are the following five books which are essential for further study:

For Salamanders: Bishop, 1943.
For Anurans (Frogs and Toads): Wright and Wright, 1949.
For Lizards: Smith, 1946.
For Snakes: Schmidt and Davis, 1941.
For Turtles: Carr, 1952.

For further information on the study of herpetology, consult your nearest University or write to the Director, Museum of Natural History, University of Kansas, Lawrence, Kansas.

Often, even after considerable effort, it may be impossible for you to identify or be confident of your identification of certain specimens. The Museum of Natural History of the University of Kansas has as one of its functions the extension of aid to those who feel the need or wish for advice and encouragement. Specimens may be shipped for checking to the Director in tight metal containers, in well-packed, well-sealed jars, or, better yet, in plastic (neoprene) bags like those used to wrap frozen foods. Be sure that the specimens are so packed that they will not jostle about. It is well to wrap each one, or each lot, in cloth (cheesecloth is commonly used) to insure constant dampness. Only enough fluid should be poured in to moisten the contents thoroughly and leave a small, unabsorbed quantity in the bottom of the container. Specimens in plastic bags may be shipped in cardboard boxes with paper or other packing.

Key to Classes

1. Limbs, if present, with claws on fingers and toes; except in soft-shelled turtles, surface of body with scales . . . *Reptilia,* p. 117
1′. Limbs always present (except in some larvae), fingers and toes always without claws; surface of body never with scales . . . *Amphibia,* p. 25

Class AMPHIBIA Linnaeus

Two of the three orders generally recognized of living amphibians occur in Kansas. The other order, the Apoda or Gymnophiona, is comprised of the caecilians only, which occur in tropical regions. All the living orders are aberrant derivatives of the distantly related, ancient amphibians (stegocephalians) and should not be considered as "typical" of the class Amphibia, especially when that class is viewed as a link between fishes and reptiles. With some justification the ancient and modern amphibians have been considered by some zoologists as comprising separate classes.

The adults or larvae of salamanders are readily distinguishable from those of anurans, and are contrasted in the following key. The eggs of the two orders are not collectively distinguishable. Unless it is known to which order any given eggs belong it will be necessary to try them in both keys. The keys to eggs are so designed that the eggs of one order will not "run down" in the key to the other order.

Key to Orders of Amphibia *

1. Tail absent; limbs always present . Salientia, p. 51
1′. Tail present; limbs present or absent.
    2. Forelegs absent or, if present, considerably less well-developed and shorter than the hind legs; tadpoles . Salientia, p. 51
    2′. Forelegs as well as hind legs always present and of about the same size, or the hind legs just slightly larger Caudata, p. 26

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* Including larvae.

Salamanders

ORDER CAUDATA Oppel

Nine species of salamanders have been recorded from the state. They represent five families. Possibly two other species occur (see p. 320). Most are confined to the eastern, relatively humid border; only one extends west of the eastern third, into the forbiddingly dry, Great Plains.

All species in the state lay eggs in water, and larvae subsequently develop which may or may not, according to species (or in *Ambystoma tigrinum* according to the individual), eventually transform. Those which transform breed only after transformation. Those which do not transform breed in the larval state and thus are sexually mature in the larval state; they are spoken of as "neotenic." *Necturus maculosus, Typhlotriton nereus* and *Cryptobranchus alleganiensis* are "obligatory" neotenes, the former two with no steps toward transformation whatever, the latter with but few; *Ambystoma tigrinum* is a "facultative" neotene, as some individuals transform while others do not. In some parts of its range, perhaps in Kansas, *Notophthalmus viridescens* is facultatively neotenic.

The eggs and breeding habits are not at all or but poorly known in all (3) members of the family Plethodontidae, although in other species they are rather well known. The larvae are known of all species, although not all stages have been observed and recorded. Identification of the larvae of species occurring within the state is relatively simple since they possess numerous characteristics of the adults. Many species of the family Plethodontidae actually lack a free-living larval stage, hatching from the egg as miniature replicas of the terrestrial adult, but none is yet known to exist in the state of Kansas.

Unfortunately salamanders all too frequently are confounded with lizards, with which they share the false (so far as species in this state are concerned) reputation of being venomous. Salamanders can be distinguished from lizards by having no scales whatever, and all species in this state have four fingers on each front limb. All the lizards have scales, and the species in this state have either five fingers on each front limb, or no limbs whatever (glass-snake lizard).

All salamanders possess numerous, small glands in the skin. These glands secrete a viscous fluid known in some foreign species to have venomous properties. No species in this country can effect harm with this secretion unless considerable quantities are eaten or applied to open wounds. Larvae are less venomous than adults.

KEY TO SPECIES OF SALAMANDERS

(Adults and Larvae)

1. Four toes on each hind foot; eyelids absent; external gills present throughout life . . . . *Necturus maculosus*, p. 48

1′. Five toes on each hind foot; eyelids present or absent; gills present or not throughout life.

  2. One, and only one, gill slit on each side of neck; prominent lengthwise folds on each side of body, and along rear margin of hind legs; no eyelids . . . . *Cryptobranchus alleganiensis*, p. 31

  2′. No gill slits at all, or else 2 on each side of neck; no folds on body or legs; eyelids present or absent.

    3. Gills present behind head.

      4. Upper fin extending forward from tail onto body at least past groin (Fig. 1).

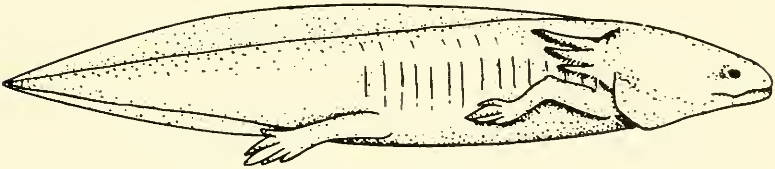


FIG. 1. Larva of the tiger salamander, *Ambystoma tigrinum*, in lateral view, × $^7/_{10}$, K. U. No. 4416. 18 miles north of Elkhart, Morton County, Kansas.

        5. Costal grooves 11-12 between limbs.

          6. Costal grooves 11 . . . . *Ambystoma maculatum*, p. 36

          6′. Costal grooves 12 . . . . *Ambystoma tigrinum*, p. 40

        5′. Costal grooves 13-14 between limbs.

          6. Jaws corneous, blackened as seen with mouth open. *Ambystoma texanum*, p. 38

          6′. Jaws not corneous, and not blackened as seen with mouth open . . . . *Notophthalmus viridescens*, p. 33

      4′. Upper fin not extending onto body from tail (Fig. 2).

        5. Costal grooves 13 or 14; 3 or fewer costal grooves separating limbs when the limbs are laid against the sides of the body with the forelimbs backward and the hind limbs forward (that is to say, "adpressed").

          6. A dorsolateral series of small round, light spots. *Eurycea longicauda*, p. 43

          6′. A dorsolateral, lateral and paravertebral series of dark spots . . . . *Eurycea lucifuga*, p. 45

        5′. Costal grooves 18 or more; 6 or more costal grooves separating limbs when they are adpressed.

          6. Costal grooves 19 to 20; 8 or 9 grooves between the adpressed limbs (not yet recorded from the state). *Eurycea multiplicata*

          6′. Costal grooves usually 18, sometimes 19; usually 6 or 7 grooves between adpressed limbs. *Typhlotriton nereus*, p. 47

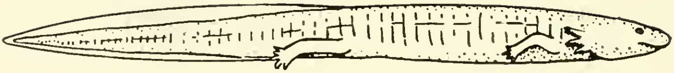


FIG. 2. An adult of the nereous salamander, *Typhlotriton nereus*, in lateral view, × 1, K. U. No. 16160, 4 miles north of Baxter Springs, Cherokee County, Kansas.

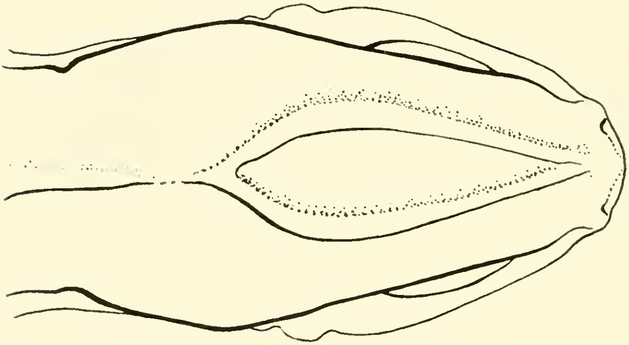


FIG. 3. Top of head of an eastern newt, *Notophthalmus viridescens*, in dorsal view, × 6, K. U. No. 23027, 3 miles southeast of Fontana, Miami County, Kansas.

3′. Gills absent.
  4. A pair of distinct, longitudinal ridges on top of head (Fig. 3); no costal (vertical) grooves or only indistinct grooves on sides of body . . . . *Notophthalmus viridescens*, p. 33
  4′. No ridges on head; costal grooves distinct.
    5. Sixteen or more costal grooves between the limbs.
      6. Belly pigmented.
        7. A prominent, broad middorsal light streak, bounded on either side by the dark color of the sides (not yet recorded from the state). *Plethodon cinereus*
        7′. Middorsum not lighter than sides (not yet recorded from the state) . . . . . . *Plethodon glutinosus*
      6′. Belly clear, unpigmented.
        7. Eyes small, their diameter entering at least 3 times into interorbital distance; 16 to 18 costal grooves (not yet recorded from the state). *Typhlotriton spelaeus*, p. 320
        7′. Eyes large, their diameter subequal to interorbital distance; 19 or 20 costal grooves (not yet recorded from the state) . . . . *Eurycea multiplicata*
    5′. Fourteen or fewer costal grooves between limbs; body slender or stout.
      6. Body light-colored above, with dark spots.
        7. A continuous, dark streak, from eye along each side of body to tail . . . . *Eurycea longicauda*, p. 43
        7′. No continuous dark streak along sides of body. *Eurycea lucifuga*, p. 45
      6′. Body dark-colored above, with or without *light* spots.
        7. No sharply outlined light spots on back or sides. *Ambystoma texanum*, p. 38
        7′. Sharply outlined light spots on back and sides.
          8. Light markings consisting of 4-7 transverse bands on dark background, their ends often uniting with a continuous dorsolateral light streak; sides not marked, uniformly dark (not yet recorded from the state). *Ambystoma opacum*, p. 320
          8′. Light markings consisting of a number of oval, round or transverse light spots, often on sides as well as on back.
            9. Belly and lower sides uniform, unspotted; only one dorsolateral series of round spots on either side of body. *Ambystoma maculatum*, p. 36
            9′. Belly or lower sides with light spots; latter not restricted to a dorsolateral series on either side, more numerous and irregularly placed, often more oval, or even in the form of vertical bars on sides of body. *Ambystoma tigrinum*, p. 40

KEY TO KNOWN EGGS OF SALAMANDERS

1. Eggs in strings, beadlike; vitellus 6 mm. in diameter, envelopes 20 mm. (Fig. 4A) .... *Cryptobranchus alleganiensis*

1′. Eggs not in strings; vitellus smaller or not; envelopes not more than 11 mm. in diameter.

    2. Eggs laid separately but in groups of 60 to 110; vitellus not pigmented, 5 to 6 mm. in diameter .... *Necturus maculosus*

    2′. Eggs not laid singly in clusters; vitellus pigmented, smaller.

        3. Eggs in a small, firm compact mass of 60 to 256 eggs. *Ambystoma maculatum*

        3′. Eggs laid singly or in small masses of not more than 8 eggs each.

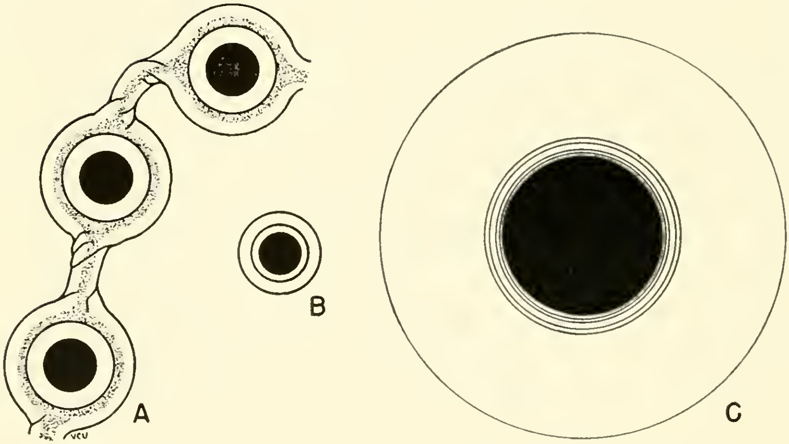


FIG. 4. A. A section of the chain of eggs of the hellbender, *Cryptobranchus alleganiensis*, from Bishop (1943), approx. × 1. B. Egg of a narrow-mouthed salamander, *Ambystoma texanum*, approx. × 3, from Haskell Bottoms, 2 miles south of Lawrence, Douglas County, Kansas. C. Egg of a tiger salamander, *Ambystoma tigrinum*, × 7, eight miles west of Clay Center, Clay County, Kansas. Figs. B and C from Smith (1934).

            4. Vitellus smaller, 1.5 mm. in diameter; envelopes elliptical, 3.5 by 2.4 mm.................... *Notophthalmus viridescens*

            4′. Vitellus larger, 2 to 3 mm. in diameter; envelopes spherical, 4 to 8 mm.

                5. Outer envelope about 4 mm. in diameter; vitellus about 2 mm. in diameter (Fig. 4B) .... *Ambystoma texanum*

                5′. Outer envelope about 7 to 8 mm. in diameter; vitellus about 3 mm. in diameter (Fig. 4C). *Ambystoma tigrinum*

FAMILY CRYPTOBRANCHIDAE

Genus *Cryptobranchus* Leuckart

Hellbender

Cryptobranchus alleganiensis (Daudin)

Salamandra alleganiensis Daudin, Hist. Nat. Rept., vol. 8, 1803, p. 231 (type locality—Allegheny Mountains in Virginia).

Cryptobranchus alleganiensis Van der Hoeven, Tijdschr. Nat. Geschied. Physiol., vol. 4, 1837, p. 384.

Range.—Extreme southeastern corner of state; recorded only from Labette (Neosho River 8 miles west of McCune) and Cherokee (1 mile north of Riverton) counties.

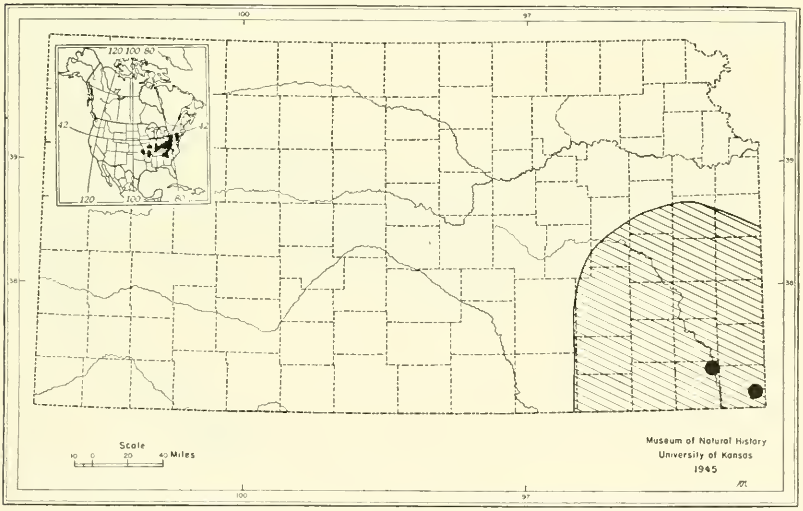


FIG. 5. Distribution of the hellbender, *Cryptobranchus alleganiensis*, in Kansas, with insert showing range of the species.

Description.—Head and body large, flat; numerous loose folds along sides of body and on posterior margins of limbs; eyelids absent; no gills; a single gill slit always present on either side of neck; tail about one-third of the total length, with a dorsal fin; no fin on body.

Dark above, a little lighter below; some indistinct dark spots on dorsal surface.

Size large, up to 27 inches in total length.

Recognition Characters.—The large size (no other Kansas salamander exceeds 17 inches in length) alone serves to identify most specimens. Individuals of any size, except the smallest larvae, can be recognized by the single slit on either side of throat.

Habits and Habitat.—The required habitat is permanent streams or rivers with several feet of water and objects on the bottom that may be used as cover. The food consists of crayfish, small fish, snails, worms, insects, and a great variety of animal refuse.

The breeding season is in the fall, commonly in September. The nest is a shallow excavation constructed on the bottom of a stream, under some object, say, a flat rock. The eggs are laid in a pair of long, rosarylike strings, while the male emits a cloudy seminal fluid over them. Three hundred to 450 eggs are deposited by a single female at one laying. This is the only American salamander which practices external fertilization; in other salamanders, spermatophores deposited by the males are picked up by the females and internal fertilization follows.

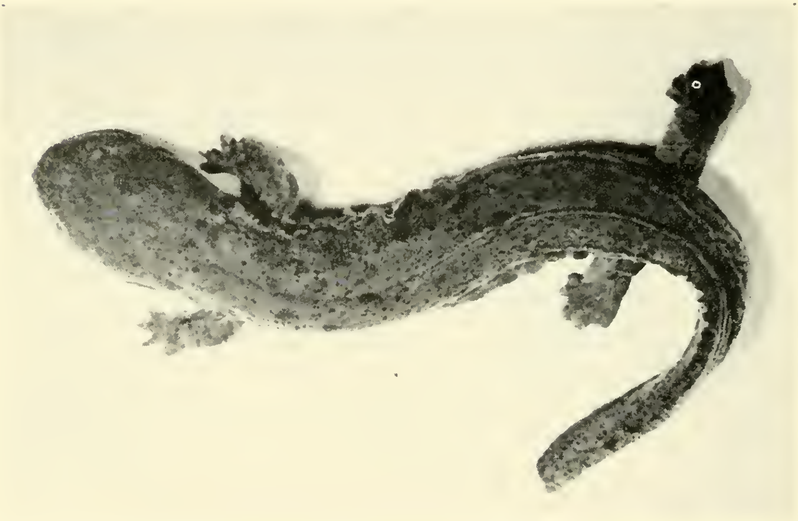


Fig. 6. A hellbender, *Cryptobranchus a. alleganiensis*, × $^1/_3$, from Big Sandy Creek, Venango County, Pennsylvania. Courtesy of the Zoölogical Society of Philadelphia.

The large eggs, ¾ of an inch in diameter (including the gelatinous envelopes), hatch in 68 to 84 days.

While not vicious, these salamanders sometimes bite most painfully. The flesh is palatable.

Kansan Subspecies.—*C. a. alleganiensis* is the subspecies occurring in Kansas. One other occurs in south-central Missouri and adjacent Arkansas. No other forms are recognized in the genus.

References.—Bishop, 1941; 37-53, figs. 2b, 4b, 9-13 (description, excellent account of natural history); Bishop, 1943: 59-63, fig. 14, map 3 (description).

FAMILY SALAMANDRIDAE

Genus *Notophthalmus* Rafinesque

Eastern Newt

Notophthalmus viridescens (Rafinesque)

Triturus viridescens Rafinesque, Ann. Nat., Lexington, no. 1, 1820, p. 5 (type locality—Lake George, or Lake Champlain, New York).
Notophthalmus viridescens Rafinesque, Ann. Nat., Lexington, no. 1, 1820, p. 5.

Range.—Extreme eastern Kansas south of the Missouri River; recorded only from Miami (Pigeon Lake), Linn (1½ miles south of Boicourt—not shown in figure 7) and Cherokee (1 mile north and 4 miles east of Crestline; 7 miles east of Baxter Springs) counties.

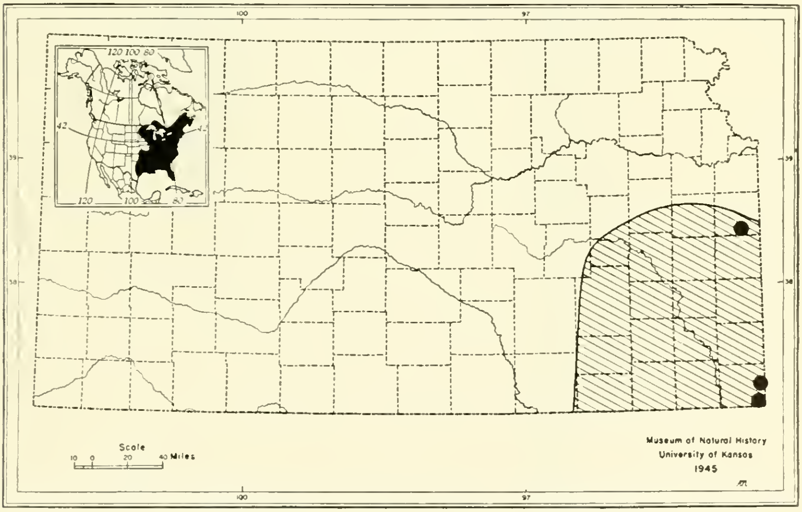


FIG. 7. Distribution of the eastern newt, *Notophthalmus viridescens*, in Kansas with insert showing range of the species.

Description.—Adults without gills or gill slits, with 4 fingers and 5 toes. Aquatic adults with prominent tail fins, the dorsal one of which extends onto body, and the skin smooth; terrestrial adults lacking fins, and skin rough, tubercular. Adults with a pair of ridges between eyes; latter with lids; no costal grooves; males with corneous patches on ventral surface of hind legs and at tips of toes, and with 3 pits on each side of head; tail slightly longer than head and body; forelegs considerably more slender than hind legs.

Aquatic adults slate above, yellowish below; small black dots on both surfaces. Terrestrial adults brick-red above, otherwise marked the same as aquatic adults.

Larvae with a dorsal fin extending onto body; 13 or 14 costal grooves discernible; jaws lacking corneous biting surfaces; ridges between eyes not well-developed.

Size small, reaching 3½ inches in total length.

Recognition Characters.—The adults are readily recognizable by the color pattern, or by the ridges between the eyes.

Habits and Habitat.—As these animals develop, they pass from an aquatic larval stage through a transformed (but not adult) terrestrial stage to an aquatic adult stage. Terrestrial forms live on land amongst leaves, under logs and in brush piles, sometimes at rather great distances from water. Aquatic forms are confined to either temporary or permanent pools, swamps and other standing bodies of water, except in rare instances. In such instances they are in migration from one pool to another or have been forced to hibernate on land since the pools previously inhabited may have been so shallow as to freeze to the bottom in winter.

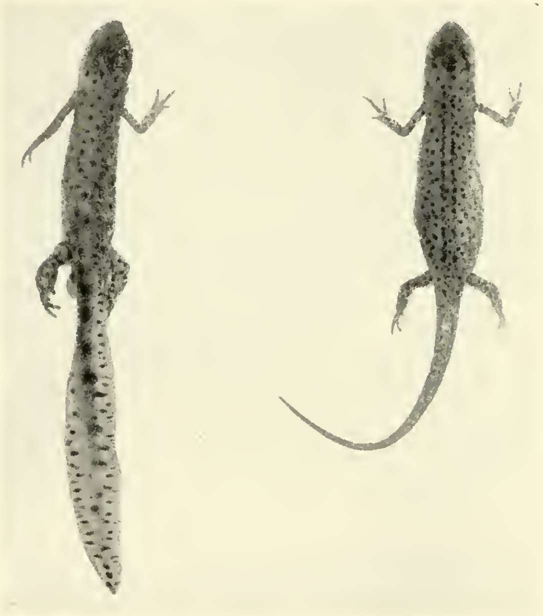


FIG. 8. Eastern newts, *Notophthalmus viridescens louisianensis*, × ¾, from Imboden, Lawrence County, Arkansas, from Smith (1934); right figure is of a female and left figure is of a male.

The food consists chiefly of worms, insects and their larvae, tadpoles, small crustaceans, and snails. Frog and salamander eggs may be eaten. Food is detected primarily by odor.

An elaborate courtship occurs in the fall, sporadically in winter, and in the spring. The male, after a short period of contortion in front of the female, climbs onto her back where he remains quietly clasping her body with his hind legs around the forepart of her body, for half an hour to several hours. After he becomes excited and drags the female about jerkily, he releases his hold and crawls in front of her, depositing 1 to 3 spermatophores. The female passes over these and some of the sperm enter her cloaca and the sperm-sacs (spermathecae) within.

The eggs are laid in the last of March or in early April, singly upon the leaves of submerged water plants. The eggs themselves measure about 1.5 mm. in diameter, and with their gelatinous envelopes about 2.5 to 3.5 mm. Normally they hatch in twenty to thirty-five days, although under laboratory conditions in as little time as twelve days.

Normally the larvae transform in three or four months, and then wander out on land for 2½ to 3½ years, at the end of which time they return as sexually mature adults. During their stay on land the skin is rough, the color is usually reddish, and there are no caudal fins. Upon returning to the water, the animals redevelop the dorsal and ventral caudal fins and assume an olive coloration, as the skin becomes smoother. Under certain conditions the larvae may remain in water and never pass through a terrestrial stage, and may even become sexually mature in a single year. Neoteny may occur.

Hibernation is temporary if it occurs at all; specimens have been seen in winter swimming about under an inch of ice.

They shed their skins at frequent intervals, sometimes taking 1½ hours for the process, pulling it off with the jaws. The shed skin is eaten. Where abundant they can be seen by day sunning themselves by floating on the water, climbing on aquatic plants, or swimming near the edge of pools. They are not particularly nocturnal, although some night activity may occur.

The above notes on natural history are of the eastern subspecies, *N. v. viridescens*. The natural history of the subspecies occurring in Kansas is almost entirely unknown. The terrestrial stage is apparently abbreviated and in some parts of the range is apparently omitted entirely from the life cycle.

Kansan Subspecies.—*N. v. louisianensis* Wolterstorff, with its type locality at New Orleans, Louisiana, is the subspecies in Kansas. Three others occur in the eastern United States.

References.—Smith, 1934: 406-413, map 4 (description, natural history); Bishop, 1941: 54-82, figs. 2g, 4c, 14-17 (superb account of natural history of *N. v. viridescens*).

FAMILY AMBYSTOMIDAE

Genus *Ambystoma* Tschudi

Spotted Salamander

Ambystoma maculatum (Shaw)

Lacerta maculata Shaw, Gen. Zoöl., vol. 3, pt. 1, 1802, p. 304 (type locality—Charleston, South Carolina).

Ambystoma maculatum Stejneger, Proc. Biol. Soc. Wash., vol. 15, 1902, p. 239.

Range.—South of Missouri River; recorded only from Douglas and Crawford (1 mile north of Pittsburg) counties.

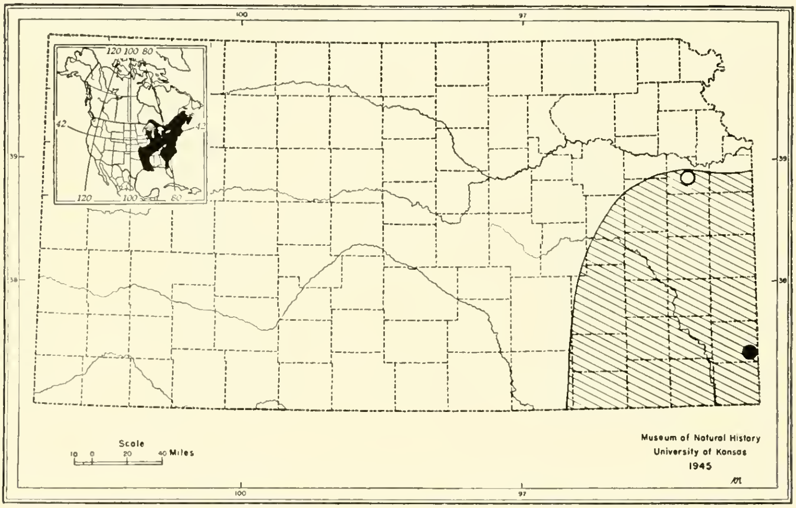


FIG. 9. Distribution of the spotted salamander, *Ambystoma maculatum,* in Kansas, with insert showing range of the species.

Description.—Adults without external gills or gill slits; hind limbs a little stouter than forelimbs; no nasolabial groove; eyes moderate in size, lidded; 12 costal grooves usually; no fin on tail or body. Dorsal surface black, slate, or bluish black. A row of rather widely separated, round, light yellow or orange spots extending along each side of body from the eyes onto the tail; these spots are not elongated transversely, and thus never reach belly nor even lower parts of sides; one small spot is regularly present back of, or to the median side of, the eye. Ventral surface light gray.

Size moderate, total length up to 7¾ inches; tail almost exactly as long as head and body.

Recognition Characters.—The pattern, consisting of rather large, rounded light spots on a dark background, is distinctive. This species is most easily confused with the tiger salamander, *A. tigrinum,* in which, however, the light spots are elongated transversely and extend far onto the sides or even onto the belly.

Habits and Habitat.—Although this species has been found in habitats varying greatly in character, it seems to be most abundant in deciduous woods where ponds, slow streams and temporary pools offer suitable breeding places. In summer, individuals often wander considerable distances from the waters in which they breed and have been found in cellars and window wells of city houses and on slopes high above the nearest pond or slow stream.

The food consists of earthworms, snails, slugs, spiders and various insects. Small fishes may be eaten by the larvae. Adults do not feed while breeding.

In the middle of March, or whenever temperatures during the day are above freezing and rains have recently fallen, these salamanders migrate at night from their terrestrial quarters to shallow ponds. Temperatures at night may be as low as freezing or as high as 46° F., but are less important by far than the occurrence of rains and diurnal temperatures above freezing. Under favorable conditions large numbers congregate at pools in areas where at other times the species may rarely be found. Males precede females by one or two days in arriving at the ponds. As the females arrive, all swim around in one or several compact groups, creating a boiling effect by their gyrations, vigorous rubbing and nosing. When conditions prevent the arrival of many individuals at one time, the communal dance just described does not occur. In courtships of single pairs, the male rubs the venter of the female with his snout, then swims away a short distance to where he deposits a spermatophore.

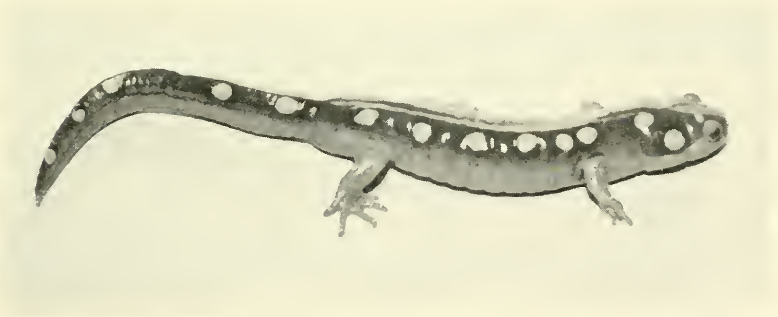


FIG. 10. A spotted salamander, *Ambystoma maculatum*, × $^2/_3$, from Hart Scout Reservation, "near Sumney town," Montgomery County, Pennsylvania. Courtesy of the Zoölogical Society of Philadelphia.

The female moves her cloaca over the spermatophore and either rests briefly in that position, allowing the sperm to enter the cloaca and the spermathecae within, or actually picks up the head of the spermatophore with the cloaca. The males deposit some forty spermatophores.

Eggs are laid a few days after mating. They are deposited in masses measuring 2½ to 3½ inches in diameter and each contains approximately 100 eggs. They are generally attached to upright stems approximately six inches below the surface of the water. They hatch forty-five to fifty days later and the larvae transform in from sixty to 115 days—as late as the middle of October in New York. In a year they grow to a length of 82 mm., and are known to live at least eighteen years.

Kansan Subspecies.—No subspecies have been distinguished in this species.

References.—Smith, 1934: 390-396, map 1, fig. 13 (description, natural history); Bishop, 1941: 108-134, figs. 2e, 4e, 23-25, 26d-f, 27 (excellent account of natural history, description).

Narrow-mouthed Salamander

Ambystoma texanum (Matthes)

Salamandra texana Matthes, Allg. deutsche naturh. Zeitschr., n. s., vol. 1, 1855, p. 266 (type locality—Colorado River, Fayette Co., Texas).

Amblystoma texanum Baird, U. S. Mex. Bound. Surv., vol. 2, Rept., 1859, p. 29, pl. 35, fig. 15.

Range.—Eastern fourth of the state. Peripheral localities on the western edge of the recorded range are in Doniphan (Doniphan

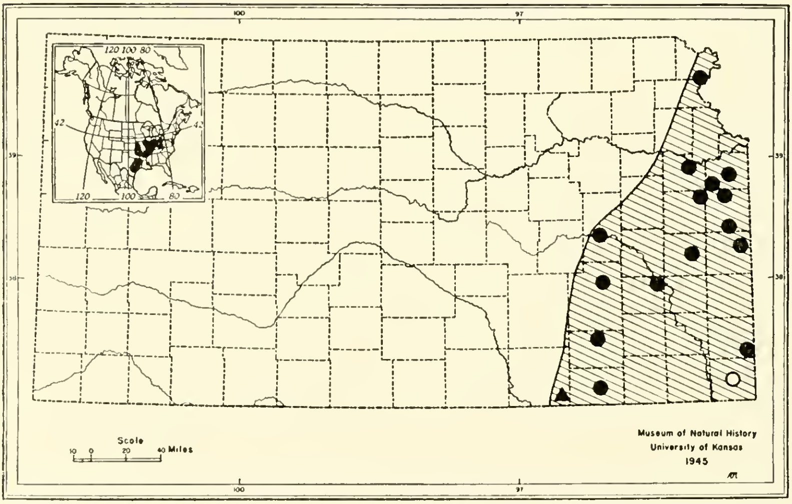


FIG. 11. Distribution of the narrow-mouthed salamander, *Ambystoma texanum*, in Kansas, with insert showing range of the species.

Lake), Douglas (Lawrence), Lyon (Emporia), Greenwood (Hamilton) and Cowley (9 miles southeast of Dexter) counties.

Description.—Adults without external gills or gill slits; hind legs a little stouter than forelimbs; no nasolabial groove; eyes moderate in size, lidded; 14 costal grooves; no fin on tail or body.

Ground color, in life, dark brown to black; dorsal surface with a variable number of grayish spots of indefinite outline, sometimes so numerous as almost completely to cover the back, at other times sparsely distributed; ventral surface with much lighter spots of somewhat more definite outline, about the size of the eyes, and usually sparsely distributed, more numerous laterally; occasionally ventral surfaces uniformly spotted.

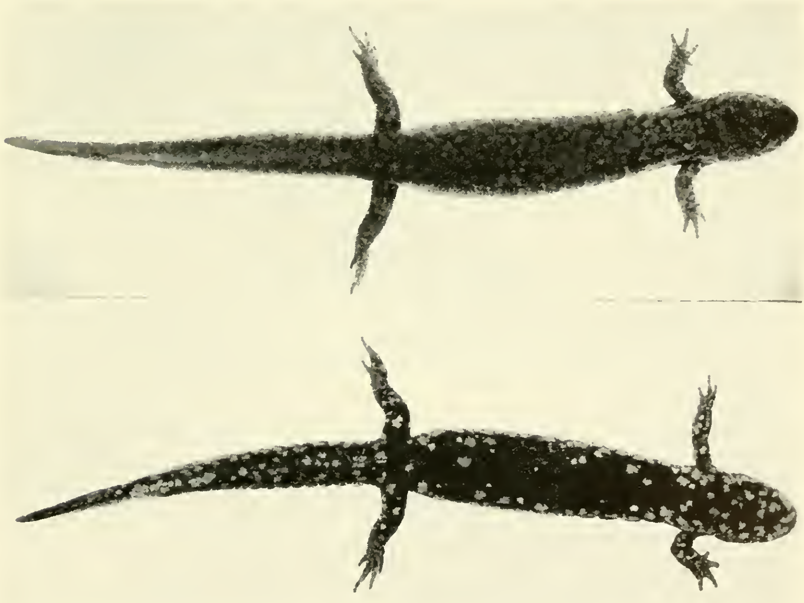


FIG. 12. Narrow-mouthed salamanders, *Ambystoma texanum*, approx. × ¾, from Haskell Bottoms, 2 miles south of Lawrence, Douglas County, Kansas; above, dorsal view; below, ventral view, from Smith (1934).

Size small, total length reaching 6½ inches; tail about ⅔ the head-body length.

Recognition Characters.—The absence of distinctly outlined light spots on the dark background is generally sufficient to identify this salamander. The other two members of the genus in Kansas have very distinct spots. Species of other genera possess distinct dark spots, or are of much larger size, or have more numerous costal grooves, or possess external gills as adults.

Habits and Habitat.—Generally they are found in damp regions close to ponds or pools. The winter probably is spent in crayfish holes or other holes near water. After the spring emergence, breeding occurs, and females remain about the water for several weeks to lay eggs. Males retire to more terrestial haunts after breeding. Both sexes spend the remainder of the year on land, where they may be found under logs and stones in damp situations, sometimes far from water. The breeding pools may disappear completely.

The food consists largely of earthworms but also of insects.

Some 700 eggs are laid in March and April, singly or in groups of 3 or 4, on upright grass stems or objects on the bottom, 1 to 6 inches below the surface of the water. The egg with its gelatinous envelopes measures approximately 4 mm. in diameter—the egg itself 2.1 mm. Ice may cover parts of some pools when eggs are laid in them.

Kansan Subspecies.—No subspecies have been distinguished anywhere in the range of this species.

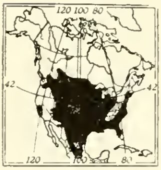
Reference.—Smith, 1934: 396-400, map 2, figs. 16, 17.

Tiger Salamander

Ambystoma tigrinum (Green)

Salamandra tigrina Green, Journ. Acad. Nat. Sci. Phila., vol. 5, 1825, p. 116 (type locality—Moorestown, New Jersey).

Amblystoma tigrina Baird, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 1, 1849, p. 284.



Range.—State-wide. Specimens are not recorded from every county but it is almost certain that this strikingly marked species does occur in every county of the state.

Description.—Adults without external gills or gill slits; hind limbs a little stouter than forelimbs; no nasolabial groove; eyes moderate in size, lidded; twelve costal grooves; no fin on tail or body.

Brownish to steel-gray above, lighter below; large whitish blotches on back and sides; dorsal spots more rounded in outline than lateral spots, usually not crossing midline; lateral spots transversely elongate, extending onto ventral surface; tail as well as limbs blotched, sometimes banded.

Size relatively large, up to 8½ inches in total length; tail ¾ to 9/10 the head-body length.

Recognition Characters.—The large, light spots, on a dark background, which extend onto the ventral surface, characterize this species. The only other species in Kansas that is likely to be confused with *A. tigrinum* is *A. maculatum* in which the pale spots are circular and do not cross the lateral surface to reach the belly.

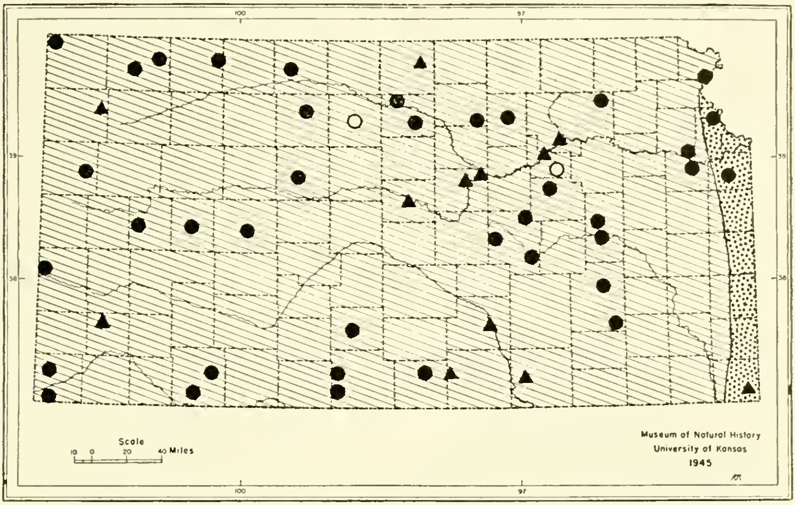


FIG. 13. Distribution of the tiger salamander, *Ambystoma tigrinum,* in Kansas. The range of *A. t. tigrinum* in the eastern part of the state is indicated by the stippled area, that of *A. t. mavortium* by the lined area.

Habits and Habitat.—Ponds, temporary pools and watering tanks are habitats of the larvae and breeding adults. Nonbreeding adults may be found hidden under debris near pools of water, or at considerable distances from water in holes of crayfish and mammals. From time to time zoölogists have found tiger salamanders emerging from prairie dog holes after dark even on rainless nights.

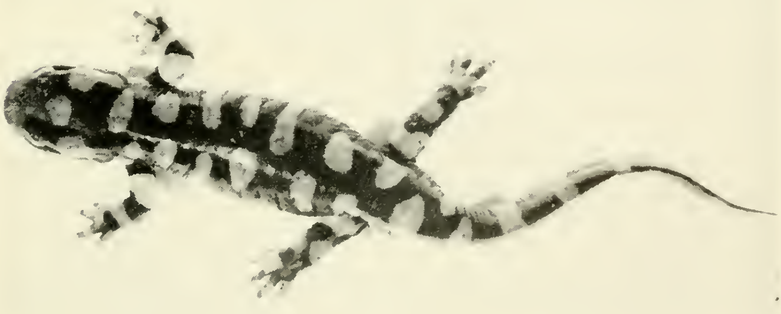


FIG. 14. An adult tiger salamander, *Ambystoma tigrinum mavortium,* approx. × ⅔, from Hamilton, Greenwood County, Kansas. Courtesy of Glenn C. Rinker and E. H. Taylor.

Mating occurs in water, with the males depositing spermatophores which the females pick up with their cloacae, after a preliminary courtship of body rubbing, tail lashing and close swimming. However, mating is not accompanied by a migration like that of *A. maculatum.*

Eggs are laid from late February to middle or late March. About a thousand are laid, singly or in pairs (sometimes 3 together), on weed stems in shallow water. They measure, with the outer gelatinous envelopes, approximately 7.5 mm. in diameter, and hatch in from fourteen to twenty days.

The larvae eat minute organisms at first and later insects, worms, tadpoles, and other larvae. Not infrequently they become cannibalistic and then grow to enormous size. Transformed specimens eat almost any moving odoriferous object. Neoteny occurs commonly.

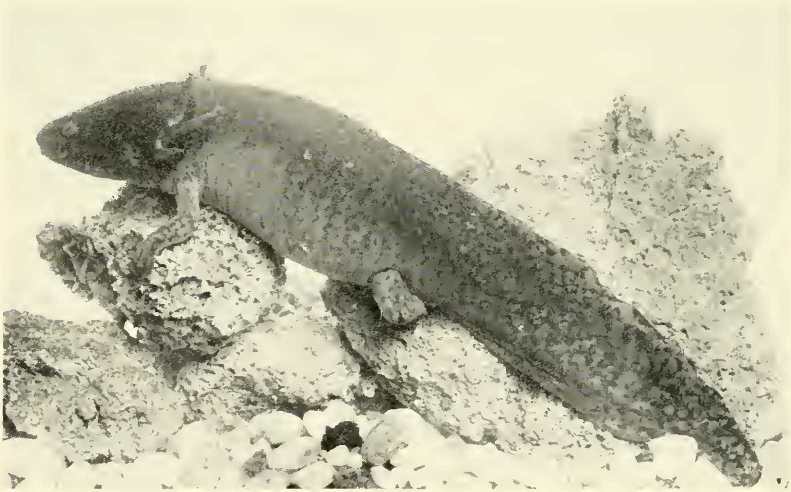


Fig. 15. A larval tiger salamander, *Ambystoma tigrinum*, approx. × 3/5. Courtesy of the New York Zoölogical Society.

The length of life is known to be at least eleven years.

Kansan Subspecies.—Two subspecies occur in Kansas: *Ambystoma tigrinum mavortium* Baird, with type locality of "New Mexico," and *A. t. tigrinum* (Green). Five other subspecies occur in the United States and at least one and possibly others in Mexico, giving a total range for the species covering most of the United States and northern Mexico. The two subspecies in Kansas may be distinguished by the shape of the light spots, which are small and ovoid in *A. t. tigrinum* even on the sides of the body, instead of being large and in the form of vertical bars as in *A. t. mavortium.*

References.—Smith, 1934: 401-406, map 3, figs. 9, 12, 14 (description, natural history); Bishop, 1941: 155-173, figs. 2f, 4g, 30-32, 33a-c, 34 (excellent general account).

FAMILY PLETHODONTIDAE

SUBFAMILY PLETHODONTINAE

Genus *Eurycea* Rafinesque

Long-tailed Salamander

Eurycea longicauda (Green)

Salamandra longicauda Green, Journ. Acad. Nat. Sci. Phila., vol. 1, 1818, p. 351 (type locality—Princeton, New Jersey).

Eurycea longicauda Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 1, 1917, p. 19.

Range.—Known only from the extreme southeastern corner of the state, near Galena, four miles north of Baxter Springs, and eight miles east of Baxter Springs, Cherokee County, Kansas.

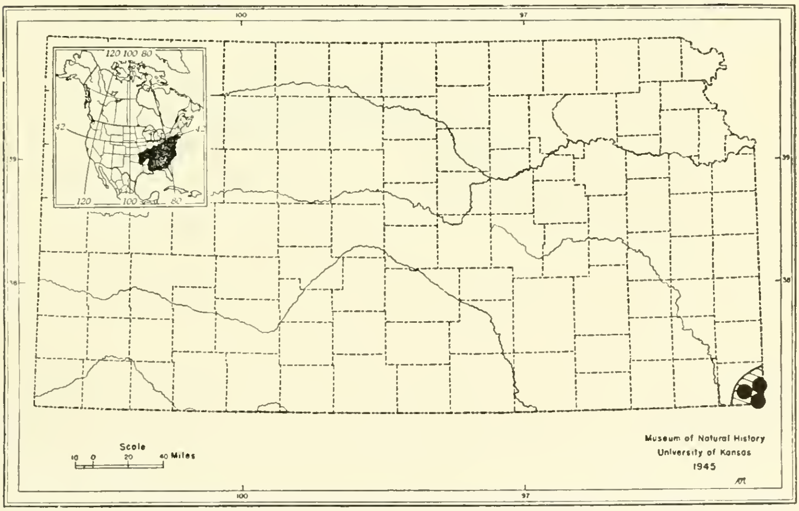


FIG. 16. Distribution of the long-tailed salamander, *Eurycea longicauda*, in Kansas, with insert showing range of the species.

Description.—A slender, small species with long tail, rather broad head and large, lidded eyes; nasolabial groove; hind legs about twice as strong as forelegs; fourteen costal grooves; adults without external gills or gill slits; no fin on body or tail.

A broad, pale yellow dorsal band on body, bordered laterally by a sharp-edged blackish area extending to sides of venter and becoming gradually lighter and interspersed with spots of same color as dorsum; ventral surfaces of body white, unspotted; a double series of, or irregularly arranged, small black spots down middle of back; top of head of same color as back, with irregularly placed, small black spots; black band on sides of body extending to posterior margin of eye; chin finely stippled; dorsal surfaces of limbs mottled; tail marked like body but without middorsal spots.

Size small, total length reaching 6 inches; tail about 1½ to 1¾ times as long as head and body.

Recognition Characters.—The dark sides and light, dark-spotted back identify this species. Somewhat similar is *E. lucifuga,* but in the latter the dark spots are scattered over the entire back and sides.

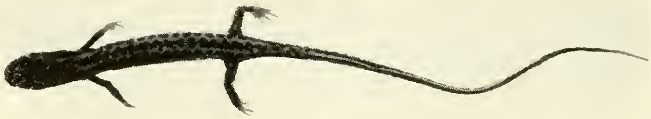


FIG. 17. A long-tailed salamander, *Eurycea longicauda melanopleura,* × ⅔, from Ravenden, Lawrence County, Arkansas, after Smith (1934).

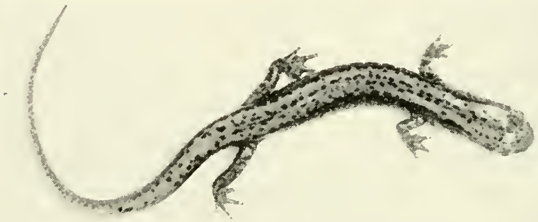


FIG. 18. A long-tailed salamander, *Eurycea longicauda melanopleura,* × 1, from Ravenden, Arkansas. Courtesy S. C. Bishop.

Habits and Habitat.—These salamanders generally are found under rocks near streams, sometimes at the mouths of caves. They are exceedingly active and if disturbed when out of water they seek to hide under debris.

Little is known of the natural history of the subspecies which occurs in Kansas. Individuals are said to feed upon spiders, mites, myriapods, insects, and some plant material. Courtship in most plethodontid salamanders is like that of ambystomids, consisting of considerable rubbing of bodies and tails. The male is most active in this process, and has special stimulating (hedonic) glands (mental) on the chin. After this "play" the male deposits a spermatophore and the female walks over it and by means of the cloaca picks up the cap containing the sperm.

Kansan Subspecies.—*Eurycea l. melanopleura* (Cope), with type locality at Rileys Creek, White River, Missouri, is the subspecies occurring in Kansas. Two other subspecies occur in the central and northeastern United States.

References.—Smith, 1934: 417-420, map 6, fig. 15; Bishop, 1941: 297-307, figs. 3f, 57a-b, 58-59 (*E. l. longicauda,* description and natural history).

Cave Salamander

Eurycea lucifuga Rafinesque

Eurycea lucifuga Rafinesque, Kentucky Gazette, Lexington, n. s., vol. 1, no. 9, 1822, p. 3, column 6 (type locality—caves near Lexington, Kentucky).

Range.—Known only from the extreme southeastern corner of the state, eight miles east of Baxter Springs, Cherokee County.

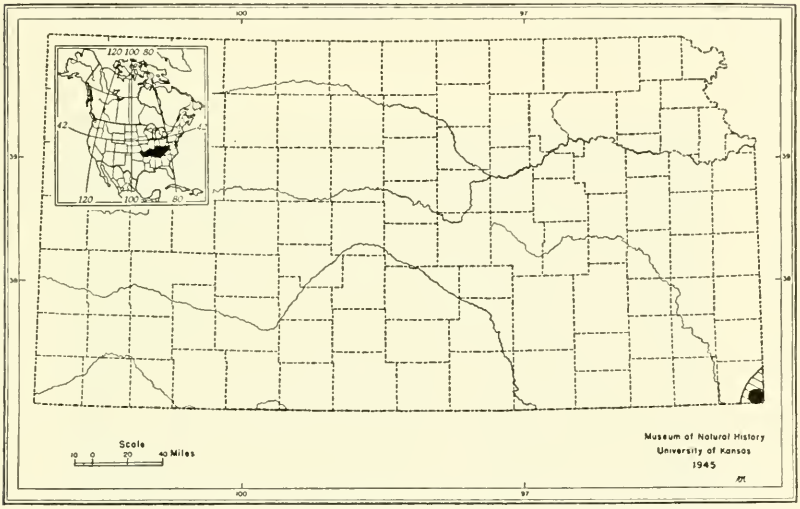


FIG. 19. Distribution of the cave salamander, *Eurycea lucifuga*, in Kansas, with insert showing range of the species.

Description.—A slender, rather small species with a long tail, rather broad, flat head and large, lidded eyes; a nasolabial groove; hind legs about twice as large as forelegs; fourteen costal grooves; adults without external gills or gill slits; no fins on tail or body.

Ground color yellow to orange, light yellow below; dorsal and lateral surfaces with numerous, scattered dark spots which may form a dorsolateral series and even a middorsal series.

Size rather small, reaching 6¾ inches in length, of which the tail comprises three-fifths to two-thirds.

Recognition Characters.—The small, dark spots on a light background distinguish this species from all others in the state except *E. longicauda.* In our race of the latter, however, the sides are dark. In rare individuals the dark spots are larger, diffuse and fused to form an irregular, somewhat reticulate pattern.

Habits and Habitat.—Generally these salamanders are to be found on floors and walls of damp caves, in the twilight areas; also they are found under logs and other debris in damp places near entrances to caves. Little is known of the natural history of this species.

In Kansas, the species is difficult to find, inasmuch as suitable habitats scarcely enter the state. Caves in the central and western parts of the state are not known to harbor cave salamanders, although occasionally rumors are circulated in various localities of cave animals that may be salamanders.

Kansan Subspecies.—No subspecies have been defined anywhere in the range of this species.

Reference.—Bishop, 1943: 431-435, map 50, fig. 129 (description).

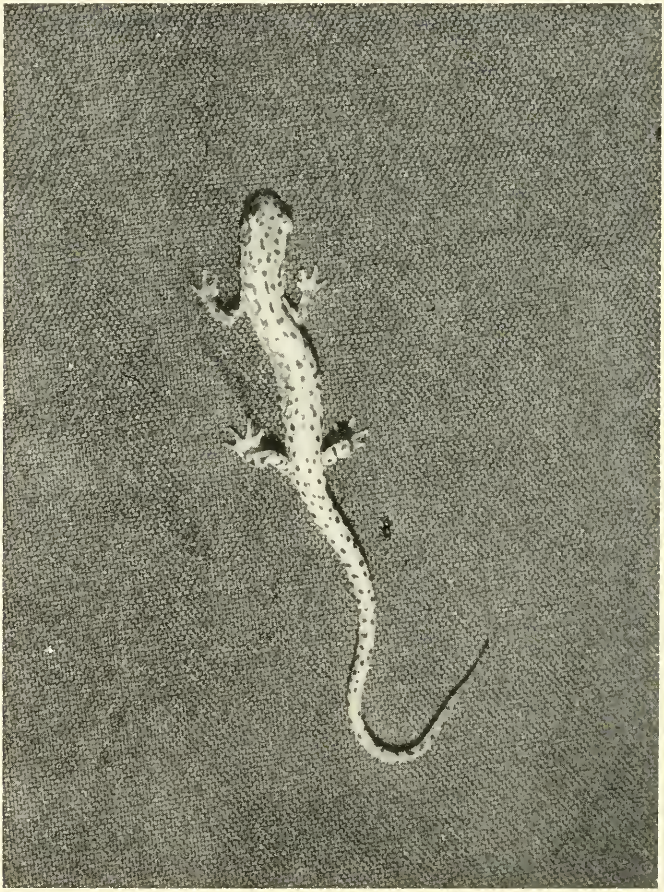


FIG. 20. A cave salamander, *Eurycea lucifuga*, × ¾, K. U. No. 24406 from 5 miles east of Baxter Springs, Cherokee County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Genus *Typhlotriton* Stejneger

Nereous Salamander

Typhlotriton nereus Bishop

Typhlotriton nereus Bishop, Copeia, no. 1, 1944, pp. 1-4, fig. 3 (type locality—York Spring, Imboden, Lawrence County, Arkansas).

Range.—Known from only the extreme southeastern corner of the state, near Galena, Cherokee county.

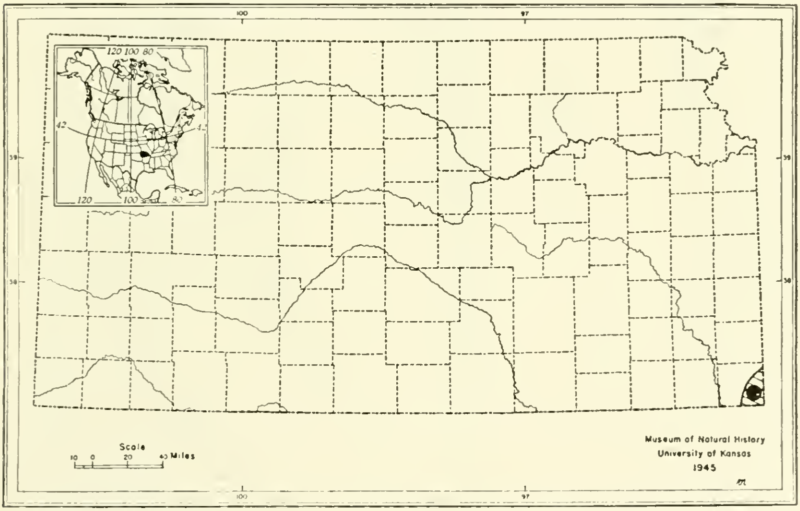


FIG. 21. Distribution of the nereous salamander. *Typhlotriton nereus*, in Kansas, with insert showing range of the species.

Description.—A small, permanently larval species never losing the gills and gill slits; eyes small, permanently open, not lidded; usually eighteen, sometimes nineteen, costal grooves; a dorsal tail-fin reaching only to anus, not onto body.

Brownish above and on sides, whitish below; pigmentation slightly irregular, with small, vague lighter areas here and there.

Size small, total length reaching 3½ inches; tail length about half of total length.

Recognition Characters.—The small size of the species and the numerous costal grooves (ordinarily 18) will usually identify it. Although only this species and *Necturus* have gills throughout life, all other salamanders in Kansas have gills for part of their lives.

Habits and Habitat.—In Kansas this species has been taken only from spring-fed, plant-choked pools in wooded, hilly areas. Little is known of its natural history anywhere in its range.

Kansan Subspecies.—None has been defined anywhere in the range of the species.

References.—Smith, 1934: 413-417 (description, habitat); Bishop, 1944: 1-5, figs. 1-4 (description, range, taxonomy).

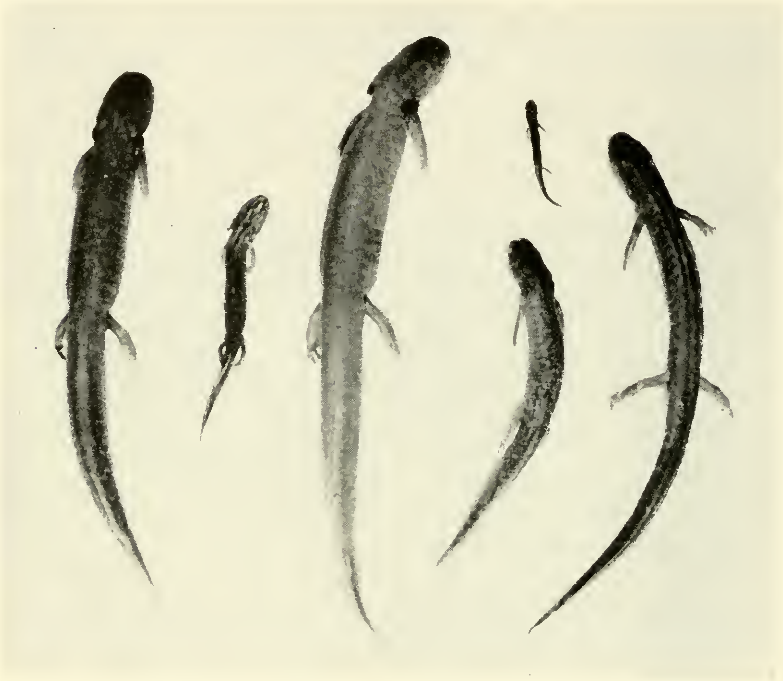


FIG. 22. Cave salamander, *Typhlotriton spelaeus*, × 1¼, from Waynesville, Pulaski County, Missouri. Courtesy Philip W. Smith. This species, not recorded from but of possible occurrence in Kansas, is indistinguishable in general appearance from *T. nereus.*

FAMILY PROTEIDAE

Genus *Necturus* Rafinesque

Mudpuppy

Necturus maculosus (Rafinesque)

Sirena maculosa Rafinesque, Amer. Monthly Mag. Crit. Rev., vol. 4, no. 1, 1818, p. 41 (type locality—Ohio River).
Necturus maculosus Rafinesque, Ann. Nat., Lexington, no. 1, 1820, p. 4.

Range.—Eastern fourth of Kansas. Peripheral localities on the western edge of the recorded range are in Douglas (Lawrence), Chase (Matfield Green) and Greenwood (Fall River) counties. Records for the northeastern and southeastern corners are lacking but to be expected in view of the known range in adjacent states.

Description.—Gills present unless lost accidentally, and gill slits invariably present; snout blunt, flattened; eyes small, lidless; a groove across under side of throat; a flap at either side of lower jaw; tail half length of body, with both dorsal and ventral fin; no fin on body; toes and fingers 4-4; costal grooves dim, about fifteen.

Adults brownish above, usually with scattered, large, rather poorly defined, black spots; ground color of belly light, at least down the middle, with variable spotting. Young with a broad, median longitudinal streak, bordered on either side by a narrower yellow stripe.

Size large, total length up to seventeen inches.

Recognition Characters.—The four toes, instead of five, on the hind limbs distinguish this species of salamander from all others in Kansas.

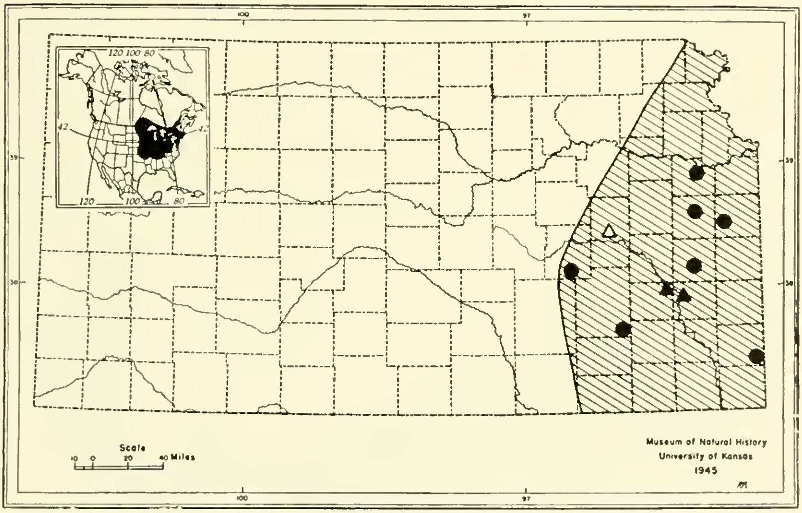


FIG. 23. Distribution of the mudpuppy, *Necturus maculosus*, in Kansas, with insert showing range of the species.

Habits and Habitat.—These salamanders are found only in streams and well-drained ponds where the water is usually three feet or more in depth, and where the bottom is provided with suitable cover for nesting sites. The necessary cover is flat stones, boards, or similar objects under which there is space sufficient for the deposition of eggs.

The food consists of crayfish, plants, insects (including larvae), fish, snails, other amphibians, leeches, and minute organisms.

There is strong evidence that mating occurs in the fall. The males deposit large spermatophores (av. 11 mm. in height, 7 mm. in width) which the females pick up with the cloaca. The eggs are laid in spring (late May) as the female finds suitable cover, turns upside down and deposits them against the under side of the protective object, from which each hangs pendantlike until it hatches. Some 60 to 140 are usually laid, in an area some 6 to 12 inches in diameter. With the gelatinous envelopes they measure 11 × 14 mm. suspended in water. The females may guard the eggs.

The eggs hatch in five or six weeks. Considerable growth occurs the first year, and the animal adds 30 to 35 mm. every year thereafter until adult size is reached, when growth is greatly slowed.

Activity is greatest at night. They instinctively shun light. Many fishermen believe that the salamanders are poisonous, although actually they are not. They may rarely bite, and the bite is painful although not serious; they can be handled with impunity.

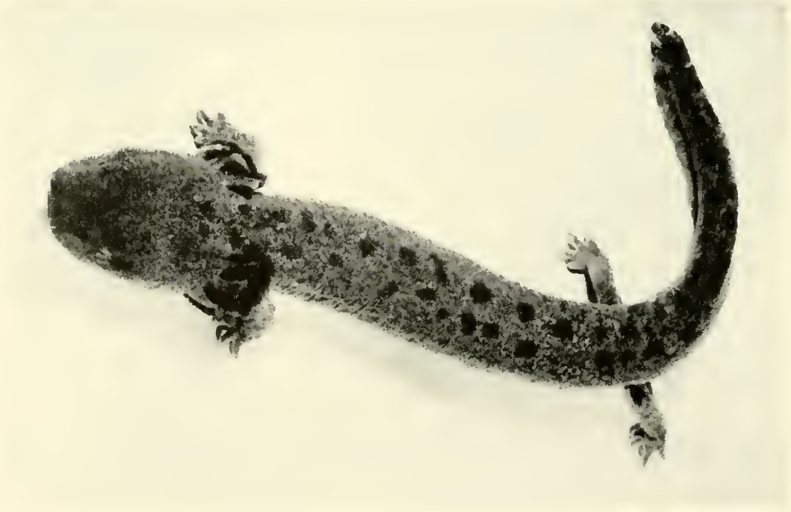


FIG. 24. A mudpuppy, *Necturus maculosus maculosus*, approx. × ⅔. Courtesy Zoölogical Society of Philadelphia.

Although some fish and fish eggs are eaten, the animals do little harm and do not deserve the persecution they suffer. They make excellent food.

Kansan Subspecies.—The subspecies *Necturus maculosus maculosus* (Rafinesque) occurs in Kansas. Only one other race, in Wisconsin, is recognized.

References.—Smith, 1934:422-427 (description, natural history); Bishop, 1941:18-37, figs. 2a, 7a, 5-8 (description, excellent natural history account, New York); Bishop, 1943: 40-43, fig. 7 (description, breeding).

Anurans (Frogs and Toads)

ORDER SALIENTIA Laurenti

Twenty species of anurans (that is, members of the order Salientia), four of which are represented by two subspecies, are known at the present time in the state. They represent five families. Two other species, as well as one additional subspecies of a species already known in the state, are of probable occurrence.

All members of this order known in this state lay eggs in water. From these hatch limbless larvae commonly known as tadpoles. In all species these larvae transform into a limbed but tailless juvenile which, after a year or two of growth, becomes sexually mature. There are no neotenic anurans.

The key to the species of anurans is given here in two parts. The first part (I) is to transformed specimens, and the second (II) is to specimens in the tadpole stage.

The larvae, or tadpoles, are characterized chiefly by the presence of a tail. Those which have not begun to transform, that is to say, those which do not have legs, are most easily identified by the tadpole key. Those which have developed forelegs as well as hind legs cannot be identified at all by that key, but should be identified by use of the key to transformed specimens. It may be necessary to try the specimens with hind legs but without forelegs in both keys in order to arrive at an identification; even then identification may be difficult.

The key to tadpoles includes only those species actually recorded from the state. The tadpoles of *Acris* have been described, but those of *crepitans* and *gryllus* have not been distinguished. Further details on most species can be found in Wright's summary of 1929. A notably workable key to genera has been written recently by Orton (1952).

Identification of tadpoles is not easy. It can be accomplished, however, by (1) use of a magnifying lens of some sort, (2) study of the accompanying drawings until the details are well in mind (especially Fig. 25), and (3) exercise of patience. Patience and perseverance, indeed, are needed to find and clearly see the structures that are important in distinguishing one kind of tadpole from another. The key characters are for the most part evident only in fully developed mouthparts, present in neither early nor late tadpole stages.

We include likewise a key to the eggs of anurans, based upon Livezey's key (1947). The eggs of two species, *Bufo debilis* and

Spea bombifrons, have not been adequately described and are not included in the key.

A common query is exactly what distinguishes frogs and toads. True toads are members of the genus *Bufo,* and toads in general are all members of primitive families up to and including the Leptodactylidae. True frogs are members of the genus *Rana,* and frogs in general are all members of the "advanced" families from the Hylidae through the remaining suborders.

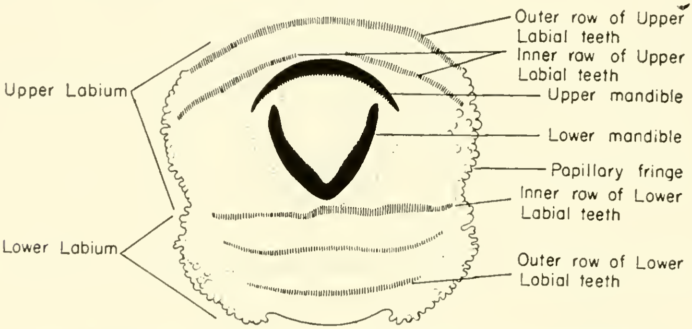

Upper Labium
Lower Labium
Outer row of Upper Labial teeth
Inner row of Upper Labial teeth
Upper mandible
Lower mandible
Papillary fringe
Inner row of Lower Labial teeth
Outer row of Lower Labial teeth

FIG. 25. Mouth-disc of a tadpole of the garden toad, *Bufo woodhousii* × 17, from Lawrence, Douglas County, Kansas (after Youngstrom and Smith, 1936).

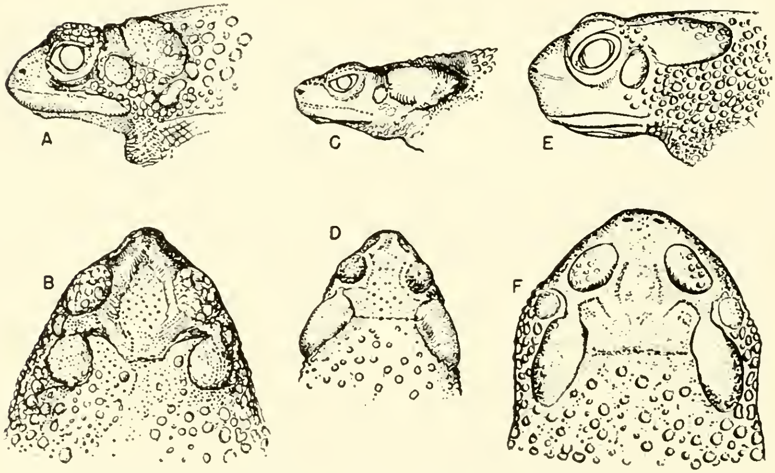


FIG. 26. Lateral A and dorsal B views of the head of a canyon toad, *Bufo punctatus,* from U. S. Nat. Mus. No. 12661, La Paz, Baja California. C and D, same, for the western green toad, *Bufo debilis,* from U. S. Nat. Mus. No. 2624, Delaware Creek, Culberson County, Texas. E and F, same, for the sonoran toad, *Bufo compactilis,* from U. S. Nat. Mus. No. 2611, "Pesquieria" Grande, Nuevo León, Mexico. All after Kellogg (1932); × 1.

KEY TO SPECIES OF FROGS AND TOADS

I. Transformed Specimens

1. An enlarged, oval or elongate, raised gland (parotoid gland) on neck behind eyes; lower surface of rear foot with small warts.

  2. Parotoid gland as broad as or broader than long (Fig. 26A, B). *Bufo punctatus,* p. 77

  2′. Parotoid gland longer than broad.

    3. Parotoid gland extending laterally below levels of lower edge of tympanum (Fig. 26C, D) . . . . *Bufo debilis,* p. 74

    3′. Parotoid gland not extending laterally beyond level of middle of tympanum.

      4. Cranial crests absent or, if present, very poorly defined and better developed behind than between orbits (Fig. 26E, F). *Bufo compactilis,* p. 72

      4′. Cranial crests well defined.*

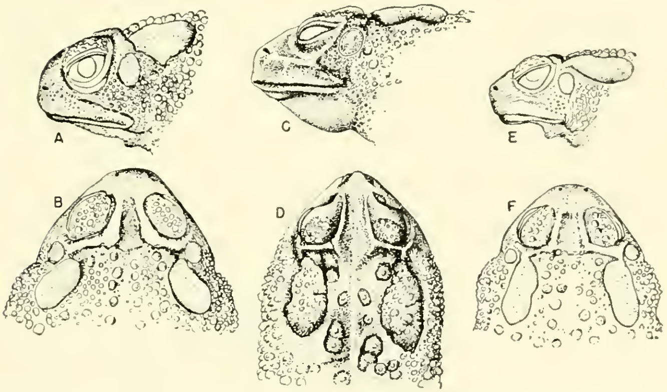


FIG. 27. Lateral A and dorsal B views of the head of a plains toad, *Bufo cognatus,* from U. S. Nat. Mus. No. 4626, Nebraska. C and D, same for the American toad, *Bufo terrestris americanus,* H. M. Smith 380, Fox Ridge State Park, Coles Co., Illinois. E and F, same, for the garden toad, *Bufo woodhousii,* from U. S. Nat. Mus. No. 2531, San Francisco Mountain, Arizona. All × 1; figs. A, B, C and F from Kellogg (1932); figs. C and D by Mrs. K. H. Paul.

        5. Pattern of large, rather closely placed, distinctly outlined and light-edged spots, sometimes elongated so as to form a reticulated pattern; ridges on head between eyes uniting on snout to form a conspicuous boss (Fig. 27A, B). *Bufo cognatus,* p. 69

        5′. Pattern usually of small spots covering but 3 or 4 warts; large spots, if present, not distinctly outlined; no boss in nasal region.

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* In immature specimens the cranial crests of all species may be poorly defined.

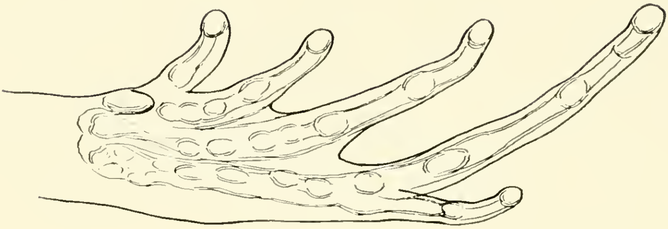

FIG. 28. Ventral view of the foot of a striped chorus frog, *Pseudacris nigrita*, showing the short web between the toes, × 7, from H. M. Smith 381, Urbana, Illinois. Drawing by Mrs. K. H. Paul.

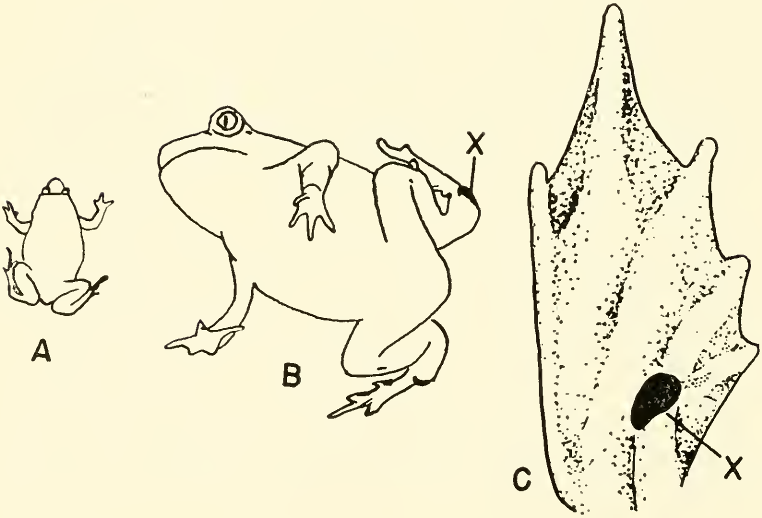

FIG. 29. A. Body outline of a narrow-mouthed frog, *Gastrophryne*, × ⅔, after Wright and Wright (1942). B. Body outline of a spadefoot, *Scaphiopus*, × ⅔, after Wright and Wright (1942), showing the *elongated* (instead of rounded) metatarsal tubercle. C. Ventral view of the foot of a plains spadefoot, *Spea bombifrons*, × 3, K. U. No. 5232, 12 miles north of Elkhart, Morton County, Kansas, showing the rounded metatarsal tubercle.

6. Median anterior surface of foot with blackish spines; parotoid gland separated from postorbital crest (Fig. 27C, D); distal subarticular tubercle almost always divided, and the penultimate one usually divided; parotoid glands broader and closer together (width 0.8 to 1.6 of least interparotoid distance); song a high trill of 10 to 30 seconds duration *Bufo terrestris*, p. 79

6′. Median anterior surface of foot warty but not tipped with blackish spines; parotoid glands in contact with postorbital crest (Fig. 27E, F); distal subarticular tubercle usually single, and the penultimate one always single; parotoid glands narrower and wider apart (width 1.7 to 2.6 times in least interparotoid distance); song a low trill of less than 5 seconds duration . . . . *Bufo woodhousii*, p. 83

1′. No parotoid gland; lower surface of rear foot warty or not.

2. Toes not webbed or only slightly so, the web never extending beyond the basal segment of the movable portion of the longest toe (as in Fig. 28); disks on toes absent or considerably less than half as wide as ear membrane.

3. No ear membrane visible; head much narrower than body (as in Fig. 29A).

4. Belly heavily pigmented except in small, scattered spots. *Gastrophryne carolinensis*, p. 113

4′. Belly pigmentless, uniformly white or yellow. *Gastrophryne olivacea*, p. 115

3′. Ear membrane distinct; head as broad as body or nearly so (except in pregnant females).

4. Usually a triangular dark mark between eyes; pattern of rather large, dark spots irregularly arranged on back; no dark line bordering upper jaw, or a very indistinct one; ear membrane nearly in contact with angle of jaw. *Pseudacris clarkii*, p. 90

4′. Usually no triangular dark mark between eyes; pattern of stripes, sometimes broken up into rows of spots; usually a distinct dark line bordering upper jaw; ear membrane distinctly separated from angle of jaw *Pseudacris nigrita*, p. 93

2′. Toes distinctly webbed, the web extending beyond at least the basal segment of the movable portion of the longest toe; disks on toes absent or, if present, at least half as wide as ear membrane.

5. An enlarged, blackened tubercle with free cutting edge at base of foot; pupil vertical in life when subjected to considerable light.

6. Blackened portion of metatarsal tubercle 2-3 times as long as broad (Fig. 29B); top of head somewhat elevated in a "boss" (not yet reported from the state) *Scaphiopus hurterii*, p. 321

6′. Blackened portion of metatarsal tubercle about as broad as long (Fig. 29C); top of head elevated or not.

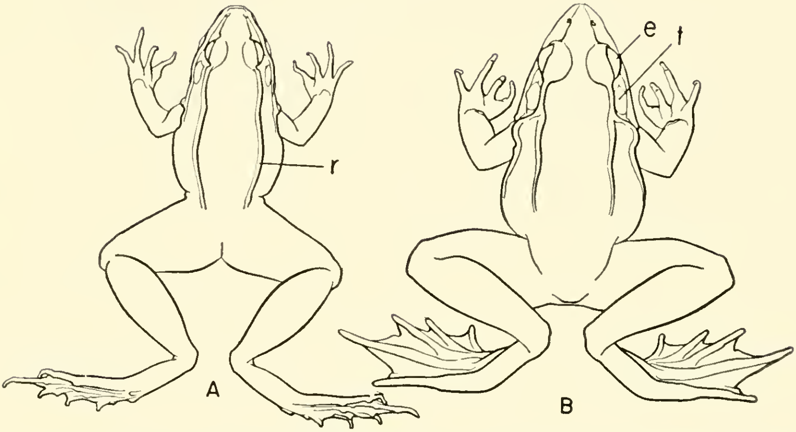

FIG. 30. A. Body outline of a leopard frog, *Rana pipiens*, K. U. No. 17882, 1 mile north of Harper, Harper County, Kansas. B. Same of a green frog, *Rana clamitans*, K. U. No. 23166, 7 miles east of Baxter Springs, Cherokee County, Kansas. Both drawings by Ann Murray, × ½; r, dorsolateral glandular ridge; e, eye; t, tympanum.

7. Top of head elevated between eyes as a boss. *Spea bombifrons*, p. 66

7′. Top of head flat (not yet reported from the state). *Spea hammondii*, p. 320

5′. No blackened or enlarged tubercle with a free cutting edge at base of foot; pupil round in light.

6. Tips of fingers and toes with enlarged disks, the largest at least half as wide as tympanum.

7. Color greenish, slate or grey; no distinct x-shaped mark on back; webs between toes extending to the terminal disks except on the longest toe . . . *Hyla versicolor*, p. 97

7′. Color brownish; a distinct, x-shaped mark on back; webs between toes extending only to next to the last joint on all except on the longest one . . . . . . *Hyla crucifer*, p. 95

6′. No disks on tips of fingers and toes.

7. A raised, ridgelike gland (Fig. 30A, r) at sides of back at least anteriorly ("dorsolateral folds").

8. No distinctly outlined dark spots on back.

9. Ear membrane ["tympanum," (Fig. 30B, t)] as large as eye (Fig. 30B, e) or larger; no dark blotch on side of head. *Rana clamitans*, p. 104

9′. Tympanum smaller than eye; a dark patch behind eye, covering tympanum and ending on shoulder *Rana sylvatica*, p. 111

8′. Distinctly outlined dark spots present on back.

9. Pattern of square or more or less rectangular spots in two rows between dorsolateral folds and in two rows on the sides; concealed surfaces of thighs and groin orange (in life). *Rana palustris*, p. 106

9′. Pattern not of square or rectangular spots; concealed surfaces of thighs and groin not orange.

10. No dark markings on back and sides between spots; dorsolateral folds usually narrow . . . . . . *Rana pipiens*, p. 109

10′. Areas between spots distinctly reticulated with a color darker than background; dorsolateral folds usually broad . . . . *Rana areolata*, p. 99

7′. No dorsolateral folds whatever.

8. Skin on belly smooth; ear membrane always distinct, as large as or larger than eye; no triangular dark mark between eyes; size (snout to vent) up to at least 175 mm. and probably more. *Rana catesbeiana*, p. 102

8′. Skin on belly granular; ear membrane indistinct, smaller than eye; a triangular dark mark between eyes; size (snout to vent) not exceeding 35 mm. *Acris crepitans*, p. 87

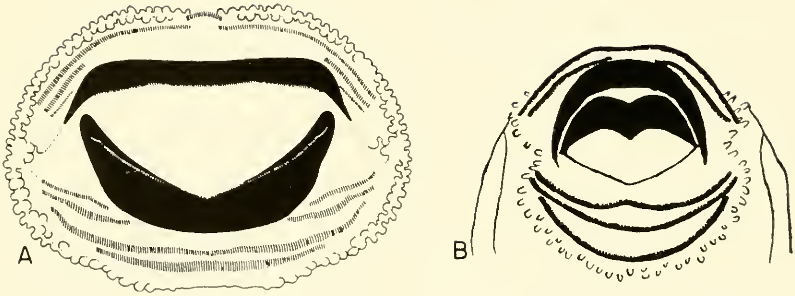

FIG. 31. Mouth-disks of anuran tadpoles. A. Plains spadefoot, *Spea bombifrons*, Meade County State Lake, Kansas, drawn by Ann Murray, approx. × 20. B. Gopher frog, *Rana areolata*, approx. × 17, Herrin, Williamson County, Illinois.

II. Tadpoles

- 1. Mouth disk absent; spiracle median, near anus.
  - 2. Eyes barely visible in ventral view; rear edge of upper labium provided with black, horny tubercles . . . . *Gastrophryne olivacea*
  - 2′. Eyes plainly visible in ventral view; rear edge of upper labium lacking tubercles . . . . *Gastrophryne carolinensis*
- 1′. Mouth disk present; spiracle sinistral.
  - 2. Papillary fringe encircling entire mouth disk except for a short space, less than one-fourth width of jaws, at middorsal border (Fig. 31A); 4 rows of teeth in lower labium (when all present and none lost in pretransformation changes) . . . . *Spea bombifrons*
  - 2′. Papillary fringe incomplete dorsally by a space more than one-third width of jaws (Figs. 25, 31B, 32, 33); no more than 3 rows of teeth in lower labium (except in *Rana sylvatica*).
    - 3. Papillary fringe encircling lower labium (Figs. 31B, 32, 33).
      - 4. Papillary fringe with a strong indentation at each corner of mouth (Fig. 31B).
        - 5. Three rows of teeth in upper labium, 4 in lower. *Rana sylvatica*
        - 5′. Two rows of teeth in upper labium, 3 in lower.
          - 6. Median space of inner row of teeth in upper labium shorter than ($\frac{2}{7}$ to $\frac{4}{7}$, usually less than $\frac{1}{2}$) either lateral part . . . . *Rana areolata*
          - 6′. Median space of inner row of teeth in upper labium as long as either lateral part, or longer.
            - 7. Median space of inner row of teeth in upper labium less than twice as long as either lateral part.
              - 8. Beak narrowly pigmented with dark, the lower mandible dark for less than half its length. *Rana catesbeiana*
              - 8′. Beak broadly pigmented with dark, the lower mandible dark nearly to base . . *Rana pipiens*
            - 7′. Median space of inner row of teeth in upper labium 2 to 11 times the length of either part.
              - 8. Median space of inner row of teeth 2 to 4 times the length of either lateral part. *Rana palustris*
              - 8′. Median space of inner row of teeth in upper labium 6 to 11 times the length of either lateral part . . . . *Rana clamitans*
      - 4′. Papillary fringe not strongly indented at each corner of mouth (Fig. 32).
        - 5. Median space of inner row of teeth in upper labium approximately equal to the length of either lateral part; 2 rows of teeth in each labium . . . . . . *Acris* (*crepitans?*)
        - 5′. Median space of inner row of teeth in upper labium one-half the length of either lateral part, or less; usually 3 rows in lower labium.

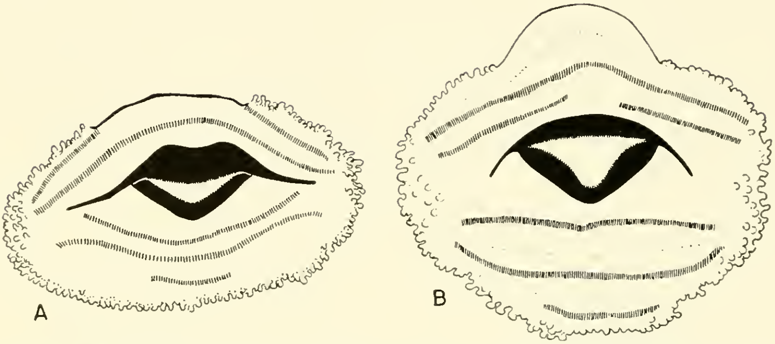

FIG. 32. Mouth-disks of anuran tadpoles. Spotted chorus frog, *Pseudacris clarkii,* from Bragg (1943), × 15. B. Striped chorus frog, *Pseudacris nigrita*, Lawrence, Douglas County, Kansas, × 15, from Youngstrom and Smith (1934).

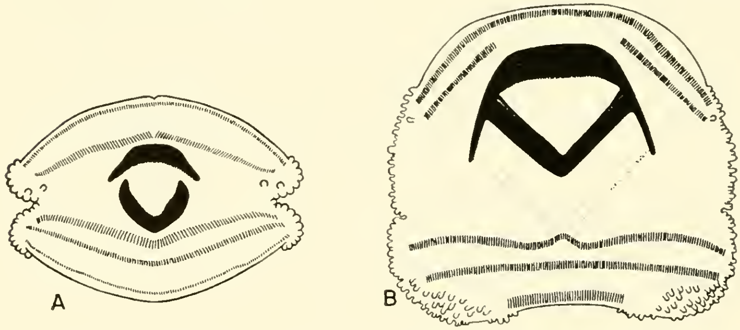

FIG. 33. Mouth-disks of anuran tadpoles. A. Green toad, *Bufo debilis,* Schwartz Cañon, Comanche County, Kansas, × 15, from Smith (1934). B. Plains toad, *Bufo cognatus,* Meade County State Park, Kansas, × 22, from Smith (1946).

- 6. Outer row of teeth in lower labium more than half length of other rows in lower labium ....*Hyla versicolor*
- 6′. Outer row of teeth in lower labium less than half length of other rows in lower labium (Fig. 32).
    - 7. Upper edge of upper mandible somewhat concave medially (Fig. 32A) .... *Pseudacris clarkii*
    - 7′. Upper edge of upper mandible convex medially (Fig. 32B).
        - 8. Outer row of teeth in lower labium no longer than half the length of either section of the inner row of teeth in the upper labium .... *Hyla crucifer*
        - 8′. Outer row of teeth in lower labium more than half the length of either section of the inner row of teeth in the upper labium (Fig. 32B)....*Pseudacris nigrita*

3′. Papillary fringe confined to sides of labia (Fig. 33).

- 4. Outer row of teeth in lower labium as long as, or longer than, innermost row.
    - 5. Median space between lateral parts of median row of teeth in upper labium one-third length of either lateral part, or longer. *Bufo punctatus*
    - 5′. Median space between lateral parts of median row of teeth in upper labium absent or much shorter than one-third length of either lateral part (Fig. 33A)..... ....*Bufo debilis*
- 4′. Outer row of teeth in lower labium shorter than innermost row.
    - 5. Outer row of teeth in lower labium usually two-thirds length of inner row, or longer.
        - 6. Median space between lateral parts of median row of teeth in upper labium one-half length of either part, or longer. *Bufo terrestris*
        - 6′. Median space between lateral parts of median row of teeth in upper labium less than one-half length of either part. *Bufo woodhousii*
    - 5′. Outer row of teeth in lower labium usually shorter than two-thirds length of inner row (Fig. 33B).
        - 6. Outer row of teeth in lower labium less than one-half length of second row (Fig. 33B)..............*Bufo cognatus*
        - 6′. Outer row of teeth in lower labium usually one-half or more length of second row.................*Bufo compactilis*

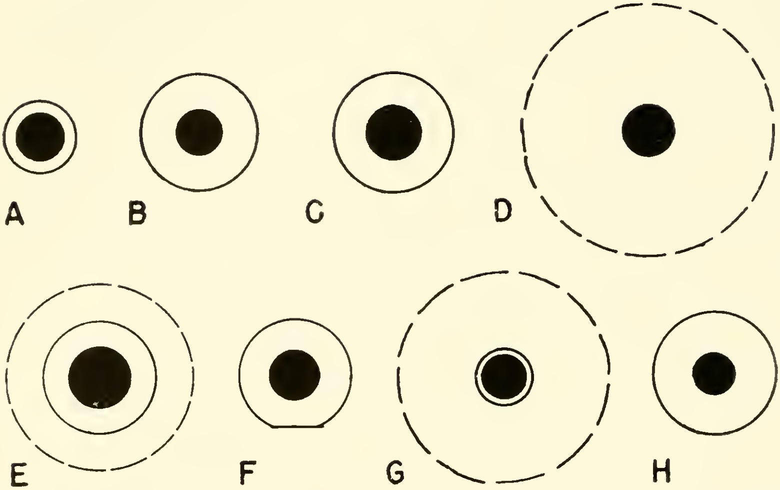

FIG. 34. Eggs of various anurans. A. Spring peeper, *Hyla crucifer*. B. Northern cricket frog, *Acris crepitans*. C. Canyon toad, *Bufo punctatus*. D. Bullfrog, *Rana catesbeiana*. E. Green frog, *Rana clamitans*. F. Eastern narrow-mouthed frog, *Gastrophryne carolinensis*. G. Common tree frog, *Hyla versicolor*. H. Western narrow-mouthed frog, *Gastrophryne olivacea*. All from Livezey and Wright (1947), × 5.

KEY TO KNOWN EGGS OF ANURANS

1. Eggs deposited singly.
  2. Envelope 1.2 to 2.0 mm. in diameter (Fig. 34A) *Hyla crucifer*
  2′. Envelope 2.4 to 3.6 mm. in diameter.
    3. Vitellus 0.9 to 1.0 mm. in diameter (Fig. 34B) *Acris crepitans*
    3′. Vitellus 1.0 to 1.3 mm. in diameter (Fig. 34C) *Bufo punctatus*
1′. Eggs deposited in groups.
  2. Egg mass in form of a surface film.
    3. Film large with a surface area of 35 sq. in. or more.
      4. Each egg with only one gelatinous envelope (Fig. 34D). *Rana catesbeiana*
      4′. Each egg with two gelatinous envelopes (Fig. 34E). *Rana clamitans*
    3′. Film small, with a surface area of 28 sq. in. or less.
      4. Envelope truncated sphere, flat above; outline of envelope distinct and firm, giving the mass a mosaic appearance (Fig. 34F) *Gastrophryne carolinensis*
      4′. Envelope round, not truncate; outline of envelope not distinct and firm.
        5. Egg masses small, of 5 to 40 eggs; a distinct inner envelope separated from vitellus by 0.2 to 0.9 mm. (Fig. 34G) *Hyla versicolor*
        5′. Egg masses large, of more than 100 and as many as 645 eggs; no inner envelope or if so scarcely separable from vitellus (Fig. 34H) *Gastrophryne olivacea*
  2′. Egg mass submerged.
    3. Egg mass in form of files or strings.
      4. Files or strings without a continuous gelatinous encasement, like a string of beads *Bufo punctatus*
      4′. Files or strings with a continuous gelatinous encasement.
        5. One cylindrical envelope; no partitions separating individual eggs.

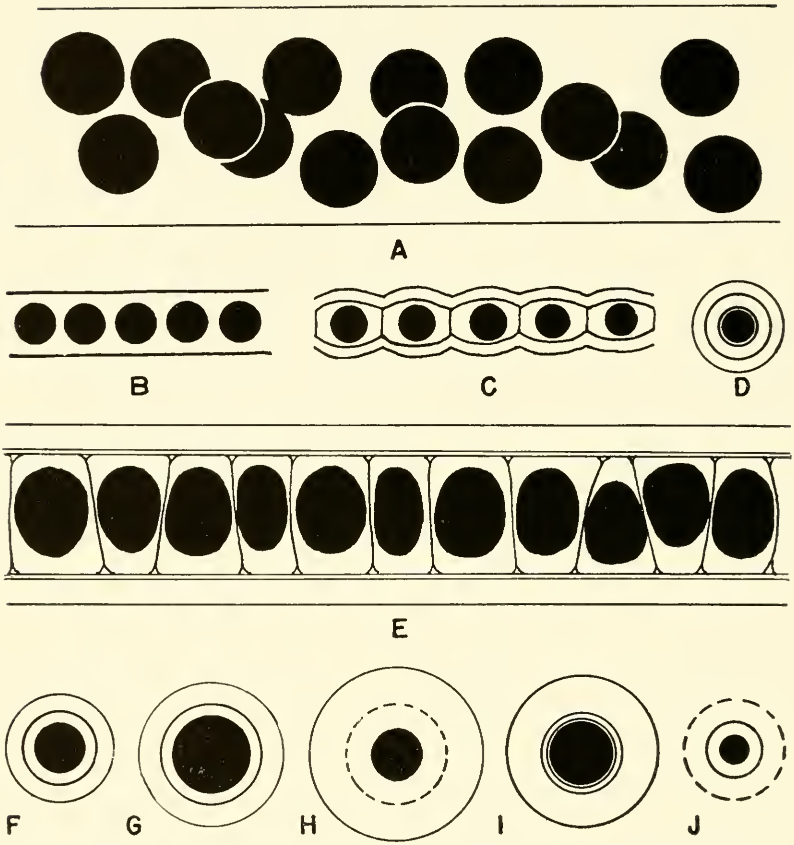

Fig. 35. Eggs of various anurans. A. Garden toad, *Bufo woodhousii*. B. Sonoran toad, *Bufo compactilis*. C. Plains toad, *Bufo cognatus*. D. Striped chorus frog, *Pseudacris nigrita*. E. American toad, *Bufo terrestris*. F. Pickerel frog, *Rana palustris*. G. Gopher frog, *Rana areolata*. H. Woodfrog, *Rana sylvatica*. I. Leopard frog, *Rana pipiens*. J. Spotted chorus frog, *Pseudacris clarkii*. Figs. A, D, E, G, I from Smith (1934); all others from Livezey and Wright (1937); figs. A, E, I, × 8; all others × 4.

6. Envelope 2.6 to 4.6 mm. in diameter (Fig. 35A). *Bufo woodhousii*

6′. Envelope 1.8 to 2.4 mm. in diameter (Fig. 35B). *Bufo compactilis*

5′. Two cylindrical envelopes; partitions separating individual eggs.

6. Envelopes decidedly scalloped, almost beadlike (Fig. 35C) .... *Bufo cognatus*

6′. Envelopes not scalloped, straight (Fig. 35E). *Bufo terrestris*

3′. Eggs in lumps.

4. Each egg with only one envelope .... *Pseudacris nigrita*

4′. Each egg with two envelopes.

5. Mass a firm regular cluster of 2,000 to 7,000 eggs.

6. Eggs brown above and yellow below (Fig. 35F). *Rana palustris*

6′. Eggs black above and white below.

7. Vitellus 2.46 to 2.50 mm. in diameter (Fig. 35G). *Rana areolata*

7′. Vitellus 1.5 to 2.4 mm. in diameter.

8. Egg mass spherical, 2.5 to 4.0 inches in diameter, of no more than 3,000 eggs (Fig. 35H) .... *Rana sylvatica*

8′. Egg mass a plinth measuring 3 to 6 by 2 to 3 inches, of 3,500 eggs or more (Fig. 35I). *Rana pipiens*

5′. Mass a loose cluster of 10 to 300 eggs, usually 1 inch or less in diameter.

6. Outer envelope 5.0 to 7.8 mm. in diameter (Fig. 35D). *Pseudacris nigrita*

6′. Outer envelope 2.2 to 2.4 mm. in diameter (Fig. 35J). *Pseudacris clarkii*

FAMILY PELOBATIDAE

Genus *Spea* Cope

Plains Spadefoot

Spea bombifrons (Cope)

Scaphiopus bombifrons Cope, Proc. Acad. Nat. Sci. Phila., 1863, p. 53 (type locality —Fort Union, Montana).

Spea bombifrons Cope, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 6, 1866, p. 81.

Range.—Western two-thirds of state, and eastward along the Kansas River as far as Lawrence, Douglas County. The other easternmost locality is Winfield, Cowley County; the species has not been taken in any of the counties north of the latitude of Lawrence and east of Phillips County (1 mile east of Glade), although it probably occurs in the northern part of the state as far east as Washington and Clay counties.

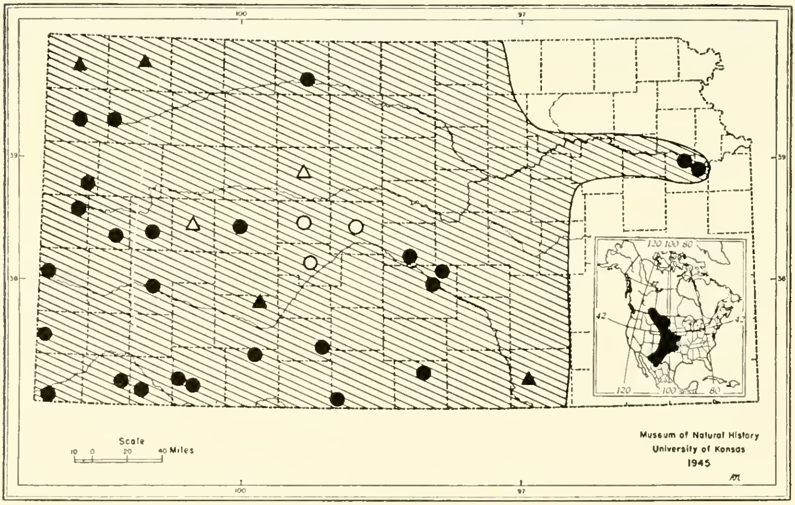

FIG. 36. Distribution of the plains spadefoot, *Spea bombifrons*, in Kansas, with insert showing range of the species.

Description.—Skin rather smooth, sometimes with low wartlike projections; eyes large, with vertical pupil; prominent, rounded elevation between eyes; parotoid gland poorly defined; tympanum scarcely visible; fingers only slightly webbed; toes nearly fully webbed; projecting, blackened, hard, inner metatarsal tubercle with rounded free edge; large outer metatarsal tubercle, not cornified; tips of fingers corneous in males.

Gray above, coarsely reticulated with darker color; venter whitish, unspotted; throat blackish in adult males; two poorly defined light stripes on each side; inner stripes originating behind orbits, converging toward shoulder region, thence diverging backwards, enclosing an oval area in middle of back, ending at rear of back; outer stripes beginning above anus, continuing along sides to groin; thighs somewhat mottled.

Size moderate, snout-vent measurement reaching 2⅛ inches.

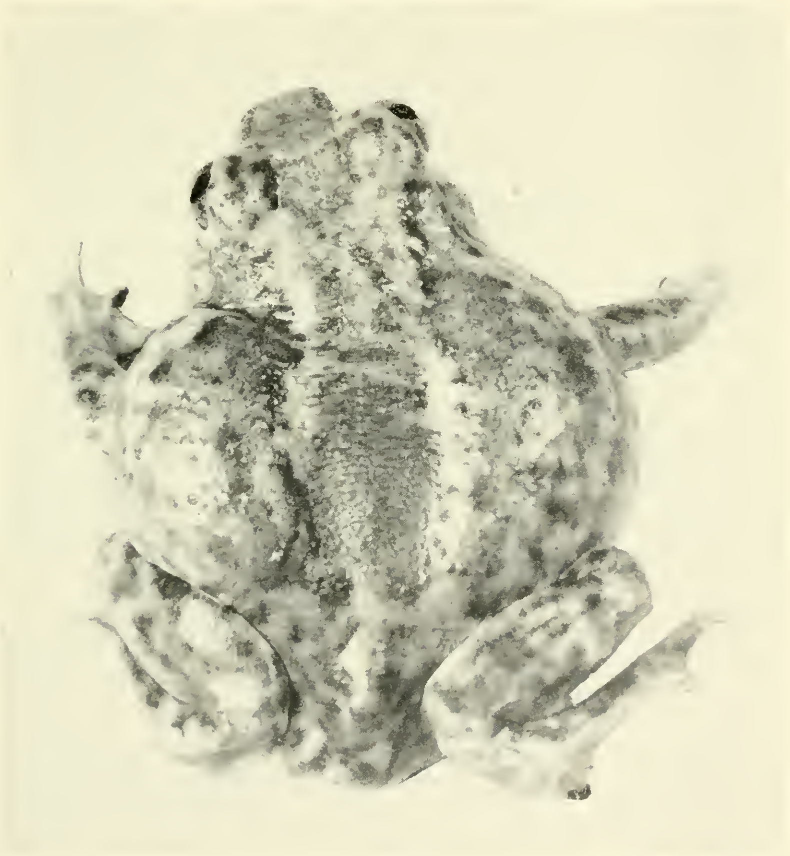

FIG. 37. Plains spadefoot, *Spea bombifrons*, × 1½, from 13 miles north of Elfrida, Cochise County, Arizona. Courtesy George M. Bradt and Charles H. Lowe, Jr.

Recognition Characters.—The vertical pupil and protruding forehead are absolutely distinctive of this species, among Kansas forms. It differs from the various species of *Bufo,* with which it is most easily confused, in the absence of a distinct parotoid gland; all other anurans differ in lacking a blackened, inner metatarsal tubercle with a free cutting edge.

Habits and Habitat.—This species, found in somewhat arid regions on sandy or other loose soil, is associated with grasslands, not normally with flood plains or woodlands. The colony established beside the Kansas River near Lawrence is of special interest since it undoubtedly owes its origin to flood-borne waifs swept perhaps 100 miles east of former range limits.

The plains spadefoot emerges only at night; at other times it is underground, where it burrows backwards with a peculiar, sideways shuffling of the rear feet. These toads burrow to any depths necessary to remain properly moist; they tend to burrow "beside objects (usually plants) where (*a*) the ground may be softer, (*b*) it is more shady, and (*c*) the burrows are not easily observed" (Bragg: 1945). Individuals emerge when moisture is abundant and the temperature high; the surface of the ground, as well as the ground below the surface, must be damp.

The food consists of almost any kind of terrestial arthropod small enough to be swallowed and large enough to be seen. The tadpoles are strongly carnivorous and frequently become cannibalistic; when cannibalistic they grow to enormous size (4½ in.). The normal transformation size is about 1⅓ inches.

There is no definite breeding season. The animals breed only during or after rains, emerging for that purpose with the first heavy rain, after a minimum spring fall of 3½ inches, occurring after temperatures reach 52° F. They breed only in temporary pools, where they convene in large numbers (both males and females), attracted by the calls of earlier arrivals. The voice is loud and harsh; it is audible in chorus for two miles on a still night. In mating, the male clasps the female with his forelegs, around the groin of the female, just in front of the hind legs.

The eggs, laid in masses of from 10 to 250 each, hatch in 48 hours. The hatchling, one-fourth inch in length, doubles its length in five days, and again with five more days, averaging then one inch in length. The hind legs appear at this time. In a total of twenty-five days the maximum length is reached. At thirty days arms appear, and transformation commences. By the fortieth day, transformation is complete. The young burrow immediately, emerging at night to feed, and after a week or so have wandered away from the pool.

Many other details of the life history have been given by Trowbridge and Trowbridge (1937) and Bragg (1945).

Kansan Subspecies.—No races have been defined anywhere in the range of this species.

References.—Smith, 1934: 427-436, map 8 (description, natural history); Trowbridge and Trowbridge, 1937: 460-480 (natural history); Bragg, 1944a: 517-533, and 1945: 52-72.

FAMILY BUFONIDAE

Genus *Bufo* Laurenti

Plains Toad

Bufo cognatus Say

Bufo cognatus Say, Long's Exp. Rocky Mts., vol. 2, 1823, p. 190 (type locality—Arkansas River, Prowers County, Colorado).

Range.—The western three-fourths of the state. Recorded as far east as Marshall (Blue Rapids), Pottawatomie, Jefferson (1 mi. E Perry), Douglas (Lawrence), Miami (3 miles southwest of Spring Hill), Marion (5 miles north of Lincolnville), Butler (El Dorado) and Cowley (Winfield) counties. The record from Lawrence can be attributed to the effect of the Kaw River, down which specimens have migrated; that from Miami County is not readily explicable; the specimen may have been introduced as a tadpole, when waters were stocked with fish from a place farther west in Kansas.

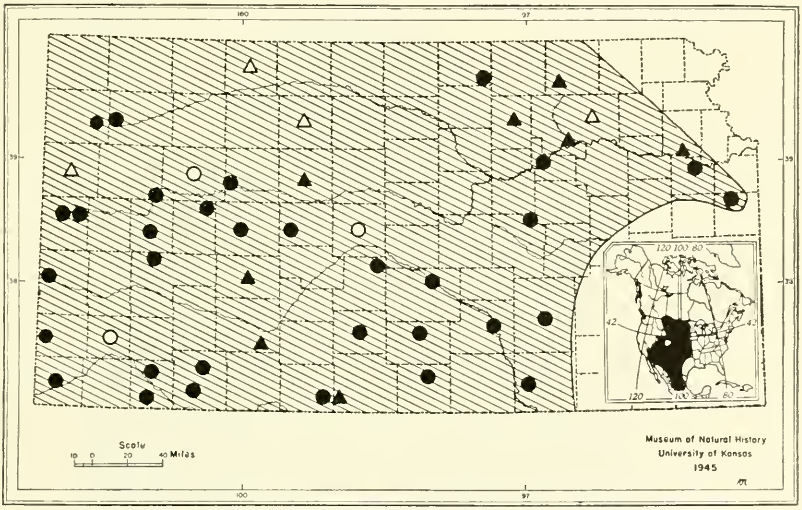

FIG. 38. Distribution of the plains toad, *Bufo cognatus*, in Kansas, with insert showing range of the species.

Description.—Skin warty; cranial crests prominent, uniting anteriorly to form a rather pronounced, smooth, flat elevation between and behind the nares; parotoid glands elongate, ovoid, in contact with crest behind eye; tympanum distinct, its diameter equal to distance between nares; inner metatarsal tubercle large, elongate, blackened, with a free cutting edge; fingers not webbed; toes about one-half webbed, with three free phalanges on fourth toe and one on others; warts on body and hind limbs equal in size, those on forelegs smaller and spinose; inner digit corneous, blackened in males.

Color yellowish above; sides and back with large brownish areas each of which is surrounded by a dark band inside a light-colored band; hind legs banded; forelegs banded or spotted; diagonal brownish crossbar across each eyelid; upper jaw banded; ventral surface yellowish, unspotted or with a few dark spots on chest.

Males possess large blackish gular pouches, and the inner fingers (thumbs) are more or less cornified; females are larger.

Size rather large, snout-vent measurement reaching 4½ inches.

Recognition Characters.—The large, distinctly outlined, dark spots, each including numerous warts, are distinctive among Kansas species of *Bufo*. All toads of the genus *Bufo* can be recognized by the distinctly evident parotoid glands. See remarks on *B. terrestris*.

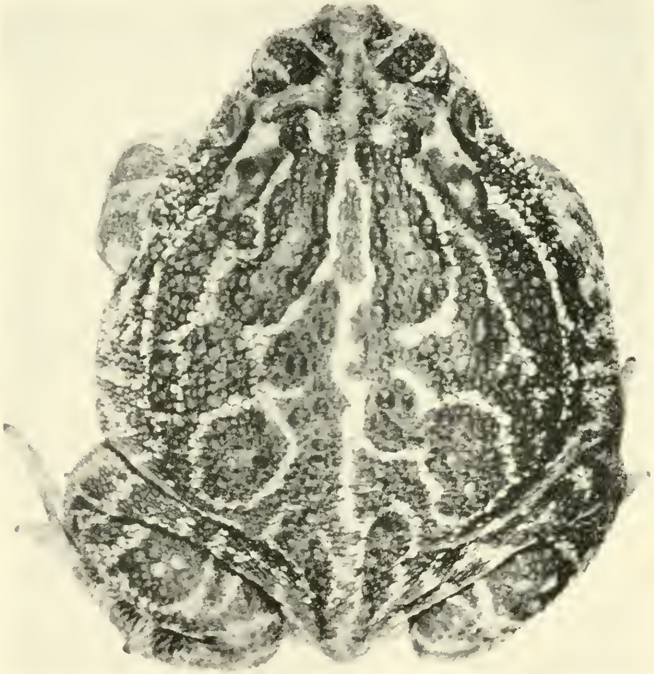

Fig. 39. A plains toad, *Bufo cognatus*, × ¾, 9 miles north of Tribune, Greeley County, Kansas, from Smith (1934).

Habits and Habitat.—This plains species is most common in long-grass and mixed-grass prairies and less common in short-grass areas where it tends to be restricted to the vicinity of streams. Usually it does not occur in wooded areas except as accidentally carried downstream into them. This species like others of the genus *Bufo* is nocturnal, although a few individuals have been observed to be active in the daytime. The call is said to be a long raucous trill of metallic timbre suggestive of grinding gears. The vocal sacs of males are enormous and kidney-shaped when inflated.

The food probably consists of practically any kind of small animal that moves. Stomachs that were examined contained snout beetles and dung beetles. Ants may comprise a large proportion of the diet.

Excerpts from Bragg's summary (1940) of the natural history of this species follow. "They breed only after rain in spring or summer when the temperature exceeds 12° C. Breeding sites in central Oklahoma include buffalo wallows, flooded fields and the edges of extensive temporary pools. They do not use ditches, 'tanks' in pastures, streams nor lakes, and they have never been known to breed in excessively muddy water. . . . The eggs are very numerous (20,000 to each full clutch), and the percentage of hatching is high. Concentration of tadpoles in some pools may exceed 750 per cubic foot of water. Food for the larvae (algae and plant and animal debris) is plentiful in the pools, and large numbers of young often succeed in passing metamorphosis. . . . The embryos and tadpoles can withstand temperatures in the pools of from near freezing to at least 37° C. and probably more.

"Metamorphosis starts at one and one-half months after eggs are laid, at a tadpole length of 26 to 29 mm. The young toads have a distinctive color pattern, the major feature of which is four to eight pairs of large dark spots on the dorsal surface and smaller spots on the sides. In two-day-old toads, the whole dorsal surface is dotted with small brick-red speckles.

"Immediately after transformation, the young toads average about 11 mm. in length, and there is not much variation among them. When, at two or three days of age, they disperse from the pool, they are about a millimeter longer. They immediately start feeding and grow very rapidly upon a diet of small insects, young snails and mites. In one week they vary much in size, the larger reaching as much as 20 mm. in length. In about four months some may be half grown (over 50 mm. in length), but others may remain much smaller. It is probable that the rate of growth of an individual is primarily dependent upon availability of food. If this be the case, then adult size may be reached in two years by some individuals but not attained by others for three or four years."

Kansan Subspecies.—No subspecies have been distinguished anywhere in the range of this species.

References.—Smith, 1934: 440-443, map 10, fig. 18 (description, natural history); Bragg, 1936: 14-20, pls. 1-2 (breeding habits, eggs, tadpole); Bragg, 1937: 273-284, figs. 1-6 (eggs, breeding habits); Bragg, 1940: 322-349, 424-438 (habits, habitat, breeding).

Sonoran Toad

Bufo compactilis Wiegmann

Bufo compactilis Wiegmann, Isis, 1833, p. 661 (type locality—Mexico City, Mexico).

Range.—Uncertain, as no definite records for the state are known. Cope (1889) reported it from "Kansas," and Bragg and Smith (1943) record the species from just south of the Kansan border in Harper County, Oklahoma (near Buffalo, 15 miles south of the Kansas line). This county is adjacent to Clark and Comanche counties, Kansas, where precise records of occurrence are to be sought.

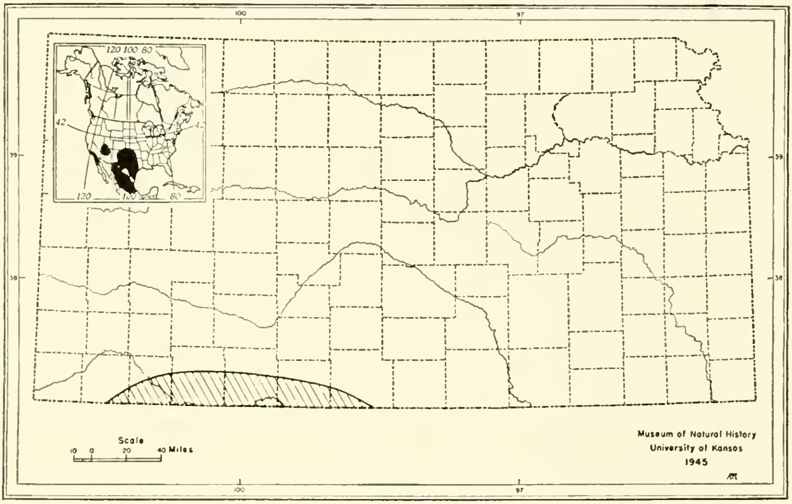

FIG. 40. Distribution of the Sonoran toad, *Bufo compactilis,* in Kansas, with insert showing range of the species.

Description.—Skin with many low warts, none notably larger than many others; cranial crests very low, clearly discernible (if at all) only behind eye; tympanum distinct, vertically oval, its horizontal diameter subequal to distance between inner edges of nares; parotoid glands small, oval, less than twice as long as broad, separated from each other by more than the length of either; inner metatarsal tubercle elongate, a little longer than first toe from the metatarsal tubercle, with a blackened free edge three times as long as wide, or longer; outer metatarsal tubercle much smaller, but blackened and with a free cutting edge; tips of toes often blackened; fingers not webbed, foot webbed at base, the web extending to the antepenultimate segment of the fourth toe, to near tip on others.

Color yellowish or gray in adults, or often both colors interspersed on the dorsal surface; young with three pairs of dark spots down the middle of the back, becoming indistinct and broken up in adults; belly uniform yellow or white, unspotted; dim cross bands present on legs.

Males with a large gular pouch of the same color as the belly, and the inner finger (thumb) more or less cornified. Females lack both modifications and are somewhat larger.

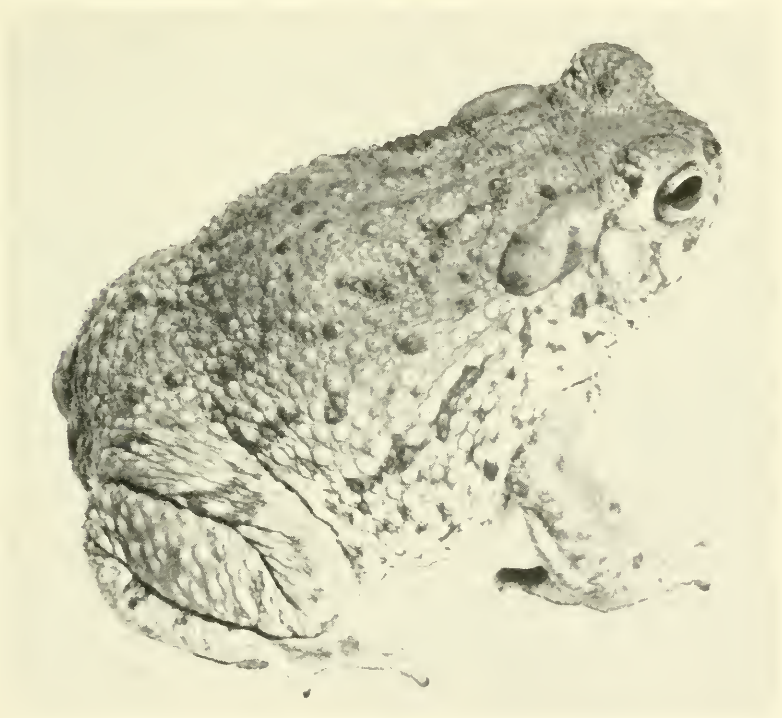

FIG. 41. A Sonoran toad, *Bufo compactilis speciosus*, × 1¼, from Tarrant County, Texas. Courtesy Louis W. Ramsey.

Size moderately large, the snout-vent measurement reaching 3⅛ inches in males, 3⅝ inches in females.

Recognition Characters.—The poorly developed cranial crests and small, oval parotoid gland but little longer than wide are, in combination, distinctive of this species. The extraordinarily well-developed metatarsal tubercles, both with free cutting edges, are unique.

Habits and Habitat.—This is a species characteristic of arid or semiarid, short-grass plains. In some areas it is extremely abundant, the dominant toad of the region. In other areas the species is rarely seen except when breeding, as both sexes congregate in large numbers about either temporary or permanent pools of water.

Breeding is initiated by heavy rainfall at any time from early spring through the summer, until the end of August. Wright describes the call as loud and shrill. The vocal sac in use is sausage-shaped, one end projecting far in front of the head.

In hot, dry weather the species is seldom seen except in moist areas and about street lights in certain parts of its range.

The food consists largely of insects but any small moving creature is likely to be taken.

The eggs are laid in narrow strings. The diameter of the tube is approximately 1.8 to 2.4 mm. in diameter. Only one gelatinous envelope, the outer cylindrical tube, is present. The eggs are small, 1.2 to 1.6 mm. in diameter, and brown or dark gray above, yellow below. The eggs are crowded in the tube, 11 to 17 per inch.

"The bicolored tadpole is small, 1 to 1⅛ inches (24 to 28 mm.), light colored, its back a drab or light grayish olive; its belly, pale cinnamon pink; its tail crests translucent. The tooth ridges are ⅔. After a tadpole period of 40 to 60 days, they transform, June 1 to August 1, at ½ inch (12 mm.)" (Wright and Wright, 1942.)

Kansan Subspecies.—One subspecies, *Bufo compactilis speciosus* Girard, with type locality at Pesqueria Grande, Nuevo León, Mexico, is known in the state. One other subspecies, in central and western Mexico, is recognized. Two other subspecies, of California and an area including adjacent parts of Nevada, Utah and Arizona, were formerly placed in this species but are now referred to the species *B. woodhousii.*

References.—Wright and Wright, 1949: 167-171 (description, natural history, illustrations); Bragg and Smith, 1943: 294-295, map, fig. 4 (distribution in Oklahoma, habits); Bragg, 1940: 8 (habits).

Green Toad

Bufo debilis Girard

Bufo debilis Girard, Proc. Acad. Nat. Sci. Phila., vol. 7, 1854, p. 87 (type locality—Matamoros, Tamaulipas, Mexico).

Range.—Southwestern Kansas, as far east as Barber County, and as far north as Logan County. Known from only four other counties: Grant, Greeley (9 miles northeast of Tribune), Hamilton, and Morton (18 miles north of Elkhart).

Description.—Head and body very flat; no longitudinal crests between eyes, or if so only a low border about eyelids; tympanum very small, oval, in contact with parotoids to the rear, smaller in diameter than internarial space; parotoids large, almost as long as head, broader than internarial space; fingers not webbed; toes one-half webbed.

Ground color above greenish; some of warts yellowish, others blackish; the latter color frequently extending over several warts, forming usually narrow streaks that may tend to give the back a reticulated appearance; hind legs faintly banded; ventral surface yellowish; belly sometimes spotted.

Size small, the snout-vent length reaching 1⅜ inches.

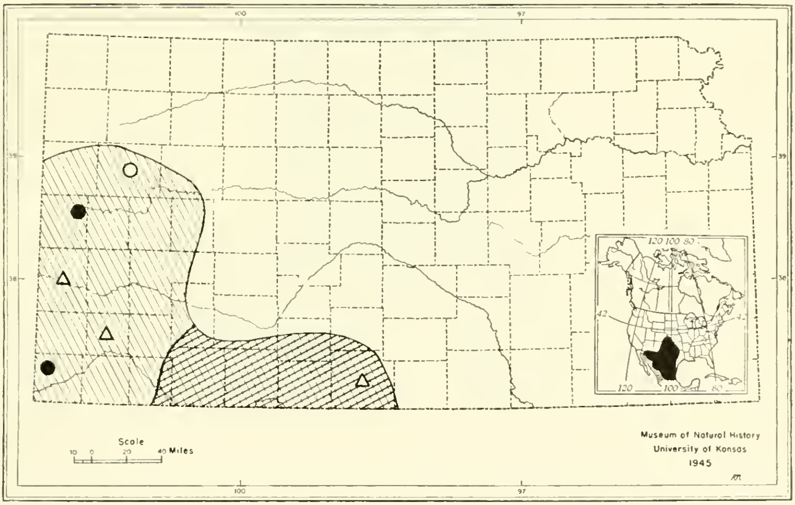

FIG. 42. Distribution of the green toad, *Bufo debilis*. in Kansas, with insert showing range of the species. The range of the eastern subspecies, *B. d. debilis*, is crosshatched; that of the western (*B. d. insidior*) is lined.

Recognition Characters.—The presence of a distinct parotoid gland identifies the members of the genus *Bufo*. Of the five species known in Kansas, only this and *B. punctatus* lack cranial crests. These two species differ in shape of parotoid glands (round in *B. punctatus*, elongate in *B. debilis*).

Habits and Habitat.—This species inhabits the short-grass prairie and sand prairie; it ranges also into mixed-grass prairie to the east. The habits are not well known. The animals emerge at night. In Texas they are said to breed in April and May, in rain-formed pools and ditches, but pregnant females of *Bufo* have been found as late as June 27, and choruses have been heard on August 8 and in early

September. The voice is said to be "cricket-like, a low sustained trill." The tadpoles have not been authoritatively identified. A series tentatively referred to this species has been described (Smith, 1934).

This is one of the few species of anurans in Kansas whose eggs are unknown.

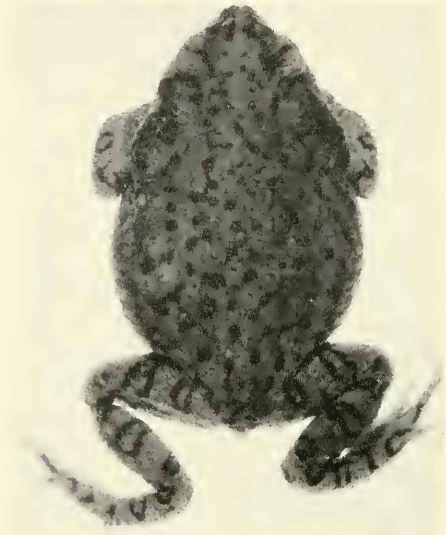

FIG. 43. A green toad, *Bufo debilis insidior*, × 1½, from 18 miles north of Elkhart, Morton County, Kansas, K. U. No. 5647, after Smith (1934).

Kansan Subspecies.—Three subspecies are recognized, two occurring in Kansas: *B. d. insidior* Girard, with the type locality at Chihuahua, Chihuahua, Mexico, and ranging from trans-Pecos Texas and southeastern Arizona northward into Kansas and southward into Mexico; and *B. d. debilis,* occurring from northeastern Mexico northward through central Texas into Kansas. The third subspecies, *B. d. retiformis* Sanders and Smith, occurs only in south-central Arizona and adjacent Mexico. In *B. d. insidior* the warts on the cranial crests are pointed and widely separated, and the ridge below eye does not extend forward beyond the level of the ridge in front of eye. In *B. d. debilis* the warts on the crests are smooth and fused to form continuous ridges, and the ridge below eye extends forward beyond the level of the ridge in front of eye. The latter tends to have smaller, more nearly round spots, whereas the spots in *B. d. insidior* tend to be narrow, elongate, and to enclose several warts.

References.—Smith, 1934: 443-446, map 11, fig. 20 (description); Wright and Wright, 1949: 172-175, pl. 34, map 12 (general account); Bragg and Smith, 1943: 295-296, fig. 5 (habitat, Oklahoma range); Savage, 1954: 83-112, figs. 1-3 (taxonomy, distribution, phylogeny); Riemer, 1955: 17-19 (taxonomy, phylogeny).

Canyon Toad

Bufo punctatus Baird and Girard

Bufo punctatus Baird and Girard, Proc. Acad. Nat. Sci. Phila., vol. 6, 1852, p. 173 (type locality—Rio San Pedro, tributary of the Rio Grande del Norte, Texas).

Range.—Southwestern Kansas. Reported only from Morton (12 miles north of Elkhart), Clark (Stephenson and Abell Ranches), Comanche (Schwartz Cañon) and Barber (1 mile west of Sunnyside School, and 5 miles south of Sun City) counties.

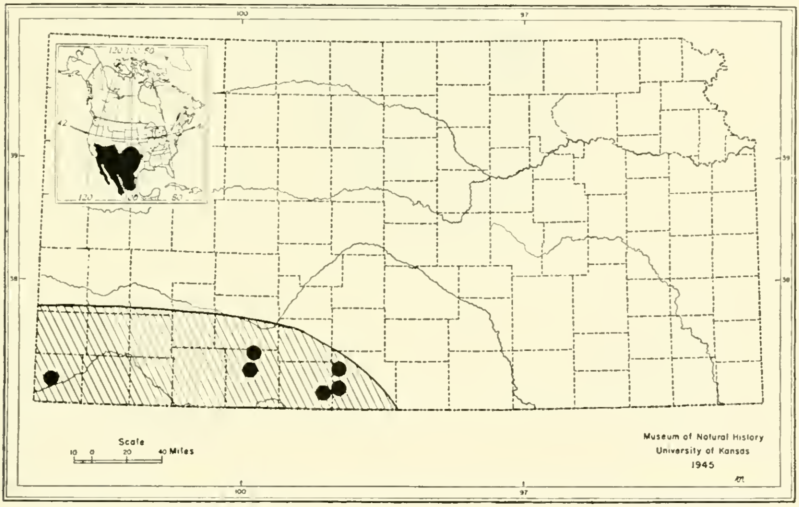

FIG. 44. Distribution of the canyon toad, *Bufo punctatus*, in Kansas, with insert showing range of the species.

Description.—Head rather flat; no cranial crests; parotoid glands small, round, little larger than eye; tympanum distinct, small, oval, equal in greatest diameter to internarial distance; body with rather large, low, smooth warts; fingers not webbed; toes half-webbed.

Color brownish or gray above, the warts more reddish and the head darker; ventral surface yellowish, with small, black spots; larger dorsal warts edged with black.

Size small, the snout-vent length reaching three inches.

Recognition Characters.—See discussion of *B. debilis.*

Habits and Habitat.—This species is known only from rocky semiarid areas, in mountains and in dissected plateaus.

Little is known of the habits. The song is said to be a "long continued trill, resembling that of a hearth cricket but with more volume" (Storer). Breeding apparently takes place in late April and early May. Larvae and recently metamorphosed young have been observed on May 28. The animals presumably are nocturnal, although they have been seen in the open in the daytime. The food consists of beetles, bugs, ants, and bees, with ants predominating; many other arthropods probably are eaten.

The eggs of this species are the most distinctive of those of any member of the genus *Bufo* in the United States. All species except this lay eggs in strings. Canyon toads, however, lay their eggs singly on the bottom of pools or streams. The eggs are protected by a sticky gelatin, and often tend to adhere one to the others in masses only a single layer in depth.

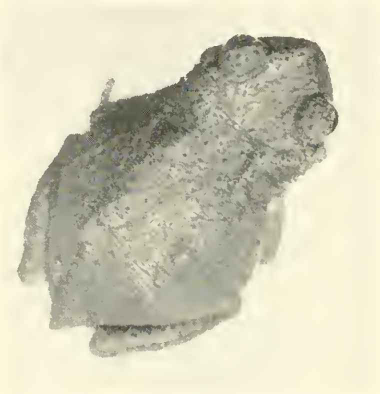

Fig. 45. A canyon toad, *Bufo punctatus*, × 1, from Helotes, Texas. Courtesy A. A. and A. H. Wright.

The vocal pouch is a more or less spherical structure when inflated. As in other anurans, this pouch occurs only in males. Of the toads of Kansas, only the sonoran toad and plains toad have the pouch, or sac, bean-shaped and extending beyond the tip of the snout.

Except in breeding choruses this species is seldom found. During dry seasons, presumably much time is spent underground; specimens have been found in prairie dog burrows at such times. In chorus, however, enormous numbers may be present, but the time of chorus is highly unpredictable and apparently dependent largely upon occurrence of heavy rainfall, even as late as September. Although resistant to semiarid conditions, these toads are yet restricted to regions of relatively high moisture content.

Kansan Subspecies.—No subspecies have been segregated anywhere in the range of this species.

References.—Smith, 1934: 446-449, map 12, fig. 21 (description, natural history); Stebbins, 1951: 280-285, pl. 17 (general account); Storer, 1925: 192-199 (description, natural history); Strecker, 1926: 8-10 (habits); Wright and Wright, 1949: 192-197, pl. 39, map 13 (general account).

American Toad

Bufo terrestris (Bonnaterre)

Rana terrestris Bonnaterre, Tabl. Encycl. Method., Erp., 1789, p. 8 (type locality—Charleston, South Carolina).

Bufo terrestris Stejneger and Barbour, Check List N. Amer. Amphs. Repts., 1917, p. 29.

Range.—The eastern quarter of the state. Peripheral localities are in Doniphan (Doniphan Lake), Osage (Carbondale), Chase (10 miles southwest of Toronto) and Chautauqua (3 miles south of Cedar Vale) counties.

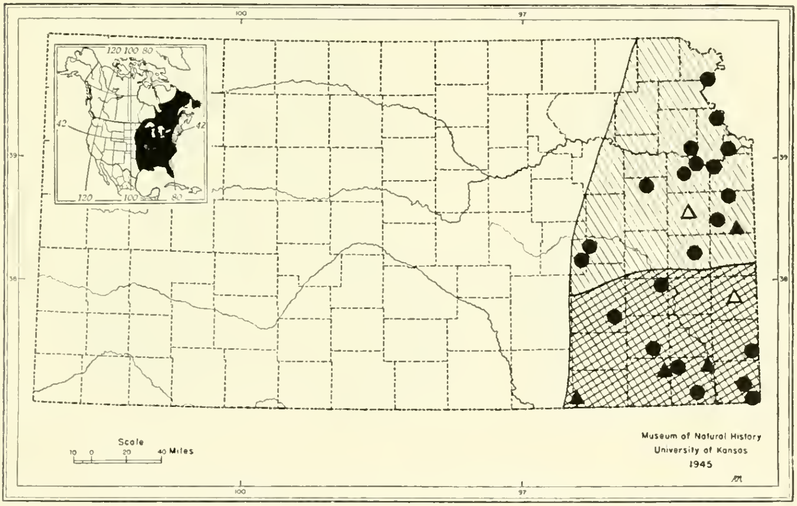

FIG. 46. Distribution of the American toad, *Bufo terrestris*, in Kansas, with insert showing range of the species. The range of *B. t. americanus* is lined, that of *B. t. charlesmithi* crosshatched.

Description.—Skin warty; warts with small apical spines; anterior surface of foot with black spines; a pair of distinct ridges between eyes, not directly bordering orbit; tympanum distinct, one-half to one-third size of eye; parotoid glands large, broad, only one-third to one-half longer than wide, separated from each other by a distance less than the length of one gland; dorsal warts of various sizes, some as large as tympanum; warts on shank as large as those of body; an enlarged brightly colored wart above and on either side of anus; large, blackened, inner metatarsal tubercle with free cutting edge; subarticular tubercles on feet frequently divided, the first tubercle practically always divided; all toes nearly fully webbed, except the three terminal phalanges of the fourth.

Color rather dark gray or reddish; a few black, light-outlined spots each surrounding one or two warts, on dorsal surface; some individuals with elongate lateral dark marks including numerous small warts; frequently a black, light-edged bar across each eyelid; upper lip banded sometimes; breast often with numerous black spots; frequently a brightly colored, red or orange patch of warts between insertion of foreleg and tympanum, and one wart above and on each side of anus.

In males throat black at least during the breeding season, and inner finger (thumb) enlarged and cornified (an aid to clasping). Females larger.

Size moderate, snout-vent measurement as much as 3⅝ inches.

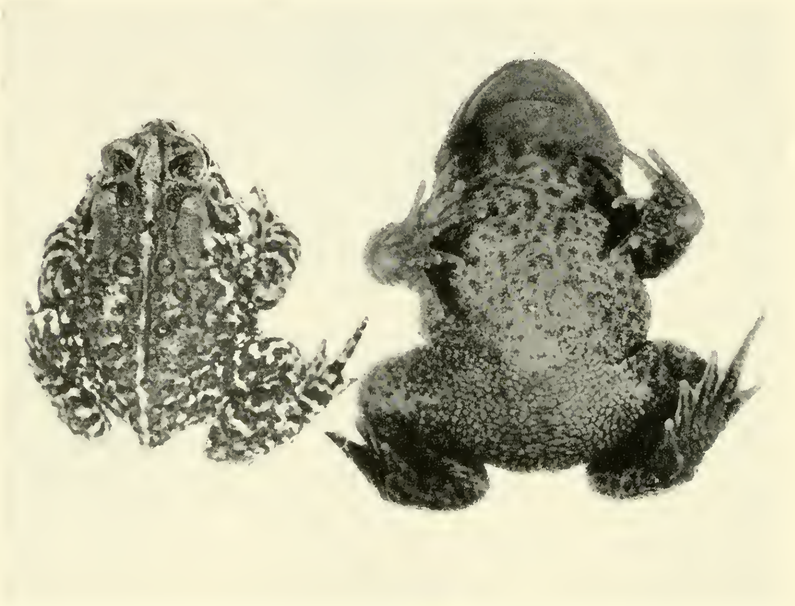

FIG. 47. American toad, *Bufo terrestris americanus*, × ⅔. Specimen at left, from Starved Rock State Park, LaSalle County, Illinois; the specimen at right is from 1 mile southwest of Carbondale, Osage County, Kansas.

Recognition Characters.—The distinct parotoid gland serves to identify this species as a member of the genus *Bufo*. From other kinds of *Bufo* in Kansas, *B. terrestris* may be distinguished by the distinct cranial crests (excludes *B. compactilis, B. debilis* and *B. punctatus*), the small dorsal dark spots (excludes *B. cognatus*), and by a number of characters that separate it from *B. woodhousii*. The latter species is the only one frequently confused with it. There are many differences between the two; nevertheless, variation in each species is so extensive that occasional specimens are not easily identified. Differences mentioned in the following parallel columns will aid in identifying specimens at least from Kansas.

	B. terrestris	*B. woodhousii*
1.	Belly usually profusely spotted.	Belly usually unspotted or with a single dark, median spot on chest.
2.	Parotoids not more than twice as long as broad, separated from each other by no more than the length of one gland.	Parotoids more than twice as long as broad, usually separated from each other by more than the length of one gland.
3.	Skin on median anterior surface of tarsi and metatarsi with blackish spines.	Skin on median anterior surface of tarsi and metatarsi without blackish spines.
4.	Warts on body more varied in size, fewer, some of them considerably enlarged.	Warts on body more uniform in size, more numerous, smaller.
5.	Usually but one or two warts to a dark color spot.	Some of dorsal spots including many warts (eastern specimens) or but one or two (western specimens).
6.	Usually no median dorsal white line.	Always a median dorsal white line.
7.	Second subarticular tubercle of fourth toe frequently divided; first almost always divided.	Second subarticular tubercle of fourth toe never divided; first seldom divided.
8.	Parotoids usually separated from postorbital ridge, and the latter in contact with tympanum either directly or by a secondary arm.	Parotoids usually in contact with postorbital ridge, and the tympanum separated distinctly from the latter.
9.	Snouts of males in lateral profile pointed to some extent.	Snouts of both males and females sharply truncate in lateral profile.
10.	A pair of brightly colored warts above anus.	No brightly colored warts above anus.
11.	Song a high trill of ten to thirty seconds duration.	Song a low trill of three to four seconds duration.
12.	Eggs laid single file, enclosed in a double tubular membrane, with a partition separating each egg from the next one.	No partitions between eggs; a single tubular membrane.

Habits and Habitat.—Individuals of *B. terrestris* live in wooded areas where rainfall is moderately high. Except in the breeding season, they are scattered far and wide, and can be found under logs, stones or other shelter in damp areas during the day. At night and in late evening they emerge from their hiding places to obtain food. Insects, worms and almost any other kind of small, moving animals are eaten.

Hibernation occurs probably in underground burrows. The toads emerge as early as the middle of March in Kansas, and soon congregate at more or less permanent pools of water to breed. Males have been heard calling as early as March 24, and as late as April 28. The song is a high-pitched trill prolonged for ten to thirty seconds. The males clasp the females about the body immediately back of the forelegs, pressing the thumbs into the region of the armpits. Eggs are laid in double strings, one from each oviduct, over a considerable period of time, as the male emits sperm to fertilize them.

The eggs measure 1.43 mm. in diameter, and are arranged single file down each tube. When examined microscopically, it can be seen that the tube is divided into cells by partitions; there is but one egg in a cell. Two membranes line the tube, the outside diameter of which is 2.86 mm. The total number of eggs laid by a single female varies from 4,000 to 20,600. The tadpoles transform fifty to sixty-five days after hatching.

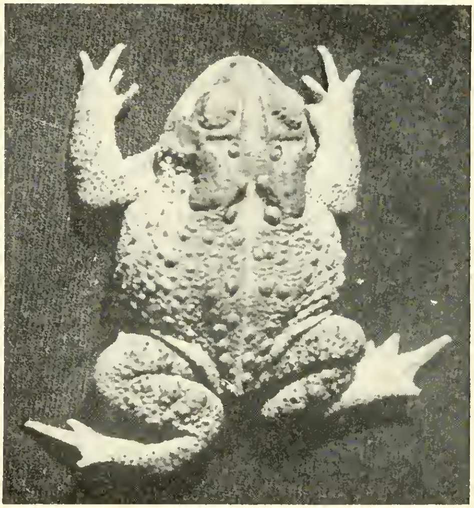

FIG. 48. An American toad, *Bufo terrestris charlesmithi*, × ¾, from 1 mile northeast of Riverton, Cherokee County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Kansan Subspecies.—Two subspecies occur in the state: *Bufo t. americanus* (with type locality at Philadelphia, Pennsylvania), and *B. t. charlesmithi* Bragg (with type locality in McCurtain Co., Oklahoma). Two other subspecies, *B. t. copei* Yarrow and Henshaw of northeastern Canada and *B. t. terrestris* of southeastern United States, are recognized. *B. t. charlesmithi* is small (seldom exceeding two and one-half inches snout-to-vent) and has an unspotted venter, whereas adult *B. t. americanus* usually exceed that size and have a heavily pigmented venter.

References.—Smith, 1934: 436-440, figs. 22, 23 (description, Kansas localities); Gage, 1904 (natural history); Miller, 1909 (natural history); Wright, 1914 (natural history); Bragg, 1954 (systematics, description of *B. t. charlesmithi*).

Garden Toad

Bufo woodhousii Girard

Bufo woodhousii Girard, Proc. Acad. Nat. Sci. Phila., vol. 7, 1854, p. 86 (type locality—San Francisco Mt., Coconino County, Arizona).

120 100 80
42
120
100
80

Range.—Throughout the state. Not recorded from the eastern border south of the Missouri River; peripheral localities in that area are in Douglas (Lawrence), Osage (Carbondale), Woodson (Neosho Falls) and Chautauqua (5 miles south of Cedar Vale) counties.

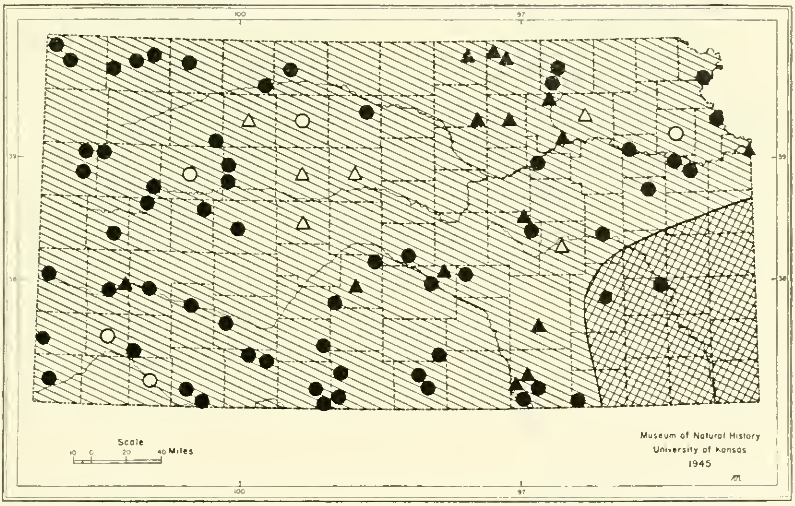

FIG. 49. Distribution of the garden toad, *Bufo woodhousii*, in Kansas. The range of *B. w. woodhousii* is lined, that of *B. w. fowleri* crosshatched.

Description.—Head thick; snout rounded, flat at tip in lateral profile; sides of head in front of eyes slanting outward at an angle of about 45°; tympanum distinct, oval, equal in greatest diameter to distance between nares; cranial crest prominent; parotoids long and narrow, separated by a distance equal to their own length, as long as head, or wide as internarial space; dorsal warts small, numerous, spinose, none enlarged; subarticular tubercles usually entire, the second sometimes divided (on foot); large, blackened inner metatarsal tubercle with a free cutting edge; toes two-thirds webbed.

Color gray or yellow above; spots on body blackish or greenish, sometimes small and including only one or two warts, but frequently large and including many warts, as in *B. w. fowleri;* a narrow, median, dorsal, light line; usually a transverse bar across orbits; upper lip with 3 bands; ventral surface usually unspotted, sometimes with a single median dark spot, rarely several spots.

In males the throat is blackish, the thumb is enlarged and cornified, the tips of the fingers corneous, the size smaller and the skin smoother than in females.

Size large, the snout-vent measurement reaching 4¾ inches.

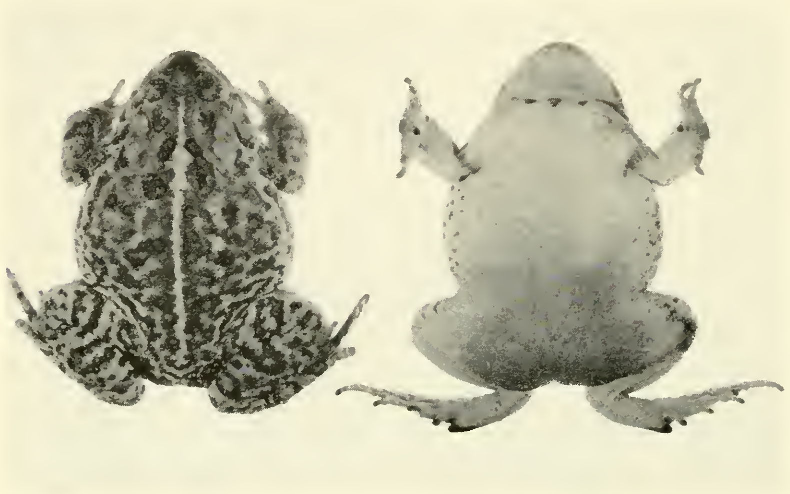

FIG. 50. A garden toad, *Bufo woodhousii woodhousii*, × ½, from 35 miles southeast of Meade County State Park, Kansas.

Recognition Characters.—See discussion of *B. terrestris,* and Figs. 47, 48, and 50.

Habits and Habitat.—Garden toads are most abundant in long-grass and mixed-grass prairie, but in the eastern part of their range they enter the periphery of wooded areas, especially in more sparsely-wooded areas and in oak-hickory associations. An enormous variety of situations is inhabited. These toads are common about human habitations and in dry river bottoms. In the central part of Kansas this species is the most common of all toads. Individuals emerge mostly at night and in the evening, when they forage for insects of many kinds. They eat bees readily upon occasion and may be a pest about apiaries for that reason. However, as a regulator of insect pests they are effective, because they have huge appetites and eat large numbers of webworms and probably other pests. It is estimated that they eat two-thirds their own volume of food every twenty-four hours. Young individuals tend to be active during the day as well as at night. Adults may emerge early in the morning to warm themselves. They retire late at night because they become cool then. In the daytime they burrow into the soil or utilize crevices under cover or ready-made holes or burrows.

Breeding occurs "in a great variety of places (cattle-tanks, ditches, flooded fields, back-washes of streams, artificial fish-pools, edges of small semipermanent artificial lakes, and sloughs on the flood plains of rivers). They are not known to use buffalo wallows and their general versatility and adaptability to conditions make this hard to explain. They seem to prefer shallow water for breeding but have been known to produce eggs in water at least three feet deep. They seem to prefer muddy water but will use clear water at times. Within any one season the breeding activities are staggered —that is, not all individuals breed at the same time even under favorable conditions. They are not dependent upon rain for breeding although most breeding activity does occur after rains in spring or summer. Congresses of this species are usually small and each male acts more or less individualistically, calling or not according to some inner urge. . . .

"Metamorphosis occurs at a total length of about 30 mm. after a tadpole period of from thirty-four to forty-five days, dependent upon both temperature and food supply. The food of the larvae is algae and organic debris of either plant or animal origin. The young toads are spotted dorsally in two colors on a grayish-brown background. The larger spots are dark-colored and of medium size; the smaller are tiny and red. . . . The young toads are active and alert. They feed upon small insects and arachnids and may grow at a rate of 0.3 mm. (*i. e.*, about 3 percent) a day. Some become half grown during the first summer. . . ." (Bragg, 1940).

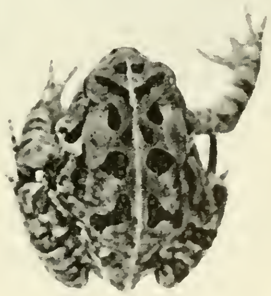

Fig. 51. A garden toad, *Bufo woodhousii fowleri*, × ⅔, from Fox Ridge State Park, Coles County, Illinois.

Breeding has been observed as early as March 25, and as late as

August 17. The song is a short, low trill of three to four seconds duration. Bragg (1950) has recorded that with air temperatures at 20° C. and water temperatures at 22° C. two or three calls are given within intervals of 10 seconds, at least under the conditions prevailing at one time when 120 10-second intervals were observed. However, rate of call is influenced not only by prevailing temperatures (air and water temperatures having different effects), but also by "social factors." Males are stimulated by the calls of their own kind, and the rate of calling is affected by the numbers calling at any one time and place. These generalizations seemingly pertain to all of the anurans possessing a voice.

The known irregularity of breeding activity in this species is, interestingly enough, correlated with irregularity of ovarian activity. Clark and Bragg (1950) record that the ovaries ". . . are not equally ready for ovulation during the known breeding period, but instead they exhibit a variation of preparedness from animal to animal in the months of March through August."

Bragg (1950) has recorded size variation in detail for Oklahoma specimens. Males are mature at a snout-vent length of a minimum of 65 mm., and reach a maximum at 99 mm.; females as small as 68 mm. snout to vent may be mature, and their maximum is reached at 126 mm. (only rarely exceeding 118 mm., however).

Kansan Subspecies.—Two subspecies occur in Kansas: *B. w. woodhousii*, with type locality at San Francisco Mt., Coconino Co., Arizona, and *Bufo w. fowleri* Hinckley, with type locality at Milton, Massachusetts. The two subspecies differ (according to Bailey and Bailey, 1940) as follows:

B. w. fowleri	*B. w. woodhousii*
1. A pattern including six well-defined, relatively large dark dorsal spots[*] which usually involve 3 or 4 warts (total in all 6 spots, 14 to 31, av. 20; 15 or more in 96 percent).	1. A pattern not of six symmetrically placed, large dark spots; largest dorsal spots usually involving 1 or 2 warts (total in 6, 6 to 18, av. 10; 13 or less in 92 percent).
2. Postorbital ridge in contact with tympanum in adults.	2. Postorbital ridge separated from tympanum in most adults.
3. Smaller, maximum snout-vent length 3 inches in males, 3¼ inches in females.	3. Larger, maximum snout-vent length 3⅜ inches in males, 6 inches in females.
4. Width of parotoid gland 1.3 to 1.9 (av. 1.7; 1.8 or less in 92 percent) in interparotoid distance.	4. Width of parotoid gland 1.7 to 2.6 (av. 2.1; 1.9 or more in 88 percent) in interparotoid distance.

References.—Smith, 1934: 449-457, map 13, figs. 22, 23 (description, natural history); Youngstrom and Smith, 1936: 630-632, figs. 2, 4, 6 (tadpole); Bragg, 1940: 306-321, figs. 1 (habits, habitat, breeding).

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[*] The six spots counted include the two lying between the anterior ends of the parotoids, two between the posterior ends of the parotoids, and two near the mid-dorsal line in the middle of the back.

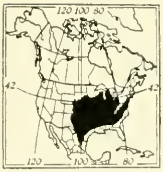
FAMILY HYLIDAE

Genus *Acris* Duméril, Bibron and Duméril

Northern Cricket Frog

Acris crepitans Baird

Acris crepitans Baird, Proc. Acad. Nat. Sci. Phila., vol. 7, 1854, p. 59 (type locality—Potomac River at Harper's Ferry, West Virginia.



Range.—State-wide, except perhaps the southwestern corner. It has not been reported southwest of Wallace (Sharon Springs), Scott (State Lake), Finney (Essex) and Seward (Arkansas River 12 miles west of Kismet) counties.

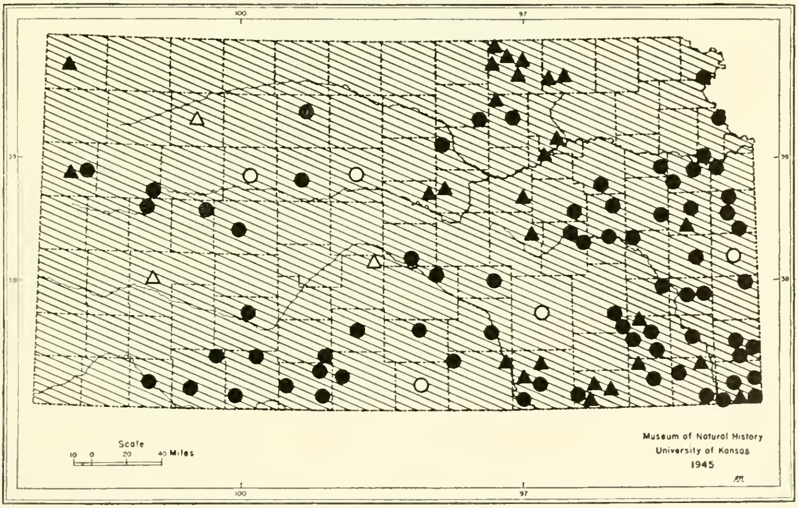


Fig. 52. Distribution of the northern cricket frog, *Acris crepitans*, in Kansas.

Description.—Skin smooth or with small, smooth warts; eyelids always warty; head rather thick, pointed; tympanum indistinct, small (half internarial distance), low (dorsal margin even with ventral margin of eye); no parotoid glands; no dorsolateral ridges; foot, excluding tarsus, half of snout-vent length or longer; toes nearly or quite fully webbed, except for the two terminal phalanges on the fourth toe; a fold across chest between armpits; ventral surfaces granular at least posteriorly; two short bones at tips of digits.

Color above slate gray; a dark, usually light-edged, triangular mark, apex directed caudad, between eyes; frequently a broad, irregular light band down back, whitish, greenish or reddish in color; back frequently with small black spots, sometimes surrounding lighter areas or warts; about four prominent dark bars across upper lip on each side; usually a distinct, broad, dark longitudinal line on posterior (concealed) surface of thigh, bordered above and below by a light color; ventral surfaces immaculate, sometimes spotted on chest and throat; usually a light-colored wart on each side of, and below anus.

Size small, the maximum snout-vent measurement being 1⅜ inches.

Recognition Characters.—This species can be distinguished from all others in Kansas by the combination of three characters, as follows: Presence of two (instead of 1) short terminal bones (about as long as broad) on digits; presence of extensive webbing on the feet; and the absence of disks on the tips of the digits. Most easily confused with *A. crepitans* are members of the genus *Pseudacris,* but these have only short webs on the hind feet. The slightly warty skin, pointed head, and the dark mark between the eyes are the characters most useful in quick identification, once a person has become familiar with the forms to be found in the state.

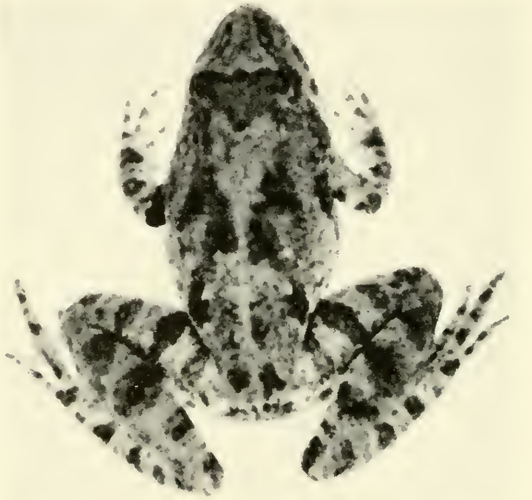


FIG. 53. A cricket frog, *Acris crepitans blanchardi,* × 3, UIMNH No. 16298 from 1 mile north and 3 miles west of Collinsville, Illinois. Photo by Charles A. McLaughlin.

Habits and Habitat.—These frogs generally are found in low vegetation on the banks of any permanent or semipermanent bodies of water. They seem to avoid deep water, yet are seldom found so far from water that they could not reach it in a few hops.

The food consists of aquatic insects, terrestrial arthropods, crayfish, ants, caterpillars, beetles, and spiders.

The frogs are active during the day as well as at night, quickly jumping into the water when disturbed and swimming promptly to the bank at some other point. They migrate at night between pools.

Breeding places include almost any water except shallow, transitory pools. The frogs emerge early in spring (late February), and remain active until late in the fall. Breeding, however, does not occur until early in April, and continues to as late as May 9. Singing males are heard as late as July 15. Amplexation (clasping of the female by the male) is axillary. Usually the eggs are laid singly; a single female lays approximately 250 eggs.

The call of this species is one of the most common of frog voices in eastern Kansas. It is a distinctive click as of small stones being struck together, repeated several times and often slurred by lessening the intervals between notes. The call is not loud and does not carry well, but until the middle of July or even later it is more frequently heard than any other. Even after that time the frogs are commonly seen, but are seldom heard.

The lazy rhythm of a small chorus of this species in late spring suggests that a sort of "call order" like that recently recorded for *Hyla crucifer* may occur. In the latter species, a chorus is composed of numerous trios, each in turn composed of three frogs emitting notes of different key. Each frog always sings the same key, and the calls are always initiated by the individual having the lowest note. The highest note is heard only after the other two have established their rhythm. The members of each trio may be widely dispersed in a chorus, but the composition of the trio remains the same despite interruptions, at least for an evening.

Whether the cricket frog actually has a similar call order is not known, but certainly the nature of the call and the apparent rhythm casually observed suggest at least the possibility of some sort of order existing. This is a fertile field for observation, for in only the one species mentioned have any observations been recorded.

Kansan Subspecies.—The Kansan subspecies is *Acris crepitans blanchardi* Harper, with type locality at Smallen's Cave, Ozark, Christian County, Missouri. One other race, *A. c. crepitans,* occurs in the eastern United States.

References.—Smith, 1934: 457-461, map 14 (description, natural history); Harper, 1947: 39-40 (description of *A. c. blanchardi*); Wright and Wright, 1949: 220-228, pl. 46, map 15 (general account).

Genus *Pseudacris* Fitzinger

Spotted Chorus Frog

Pseudacris clarkii (Baird)

Helocactes clarkii Baird, Proc. Acad. Nat. Sci. Phila., vol. 7, 1854, p. 60 (type locality—Galveston, Texas).
Pseudacris clarkii Smith, Amer. Midl. Nat., vol. 15, 1934, p. 462.

Range.—South-central Kansas from Rush County (Nekoma) south through Lyon and Sedgwick counties (10 miles north of Wichita) on the east and Meade County on the west. Known from only six other localities: Cheyenne Bottoms south of Hoisington, Barton County (not shown in fig. 54); 10 miles south of Ensign, Gray County; Kingsdown, Ford County; Rezeau Ranch, Kiowa County; three miles southwest of Sun City, Barber County; and Harper, Harper County.

Description.—Skin perfectly smooth; head rather flat; tympanum distinct, rather large, round, in contact with angle of jaw, separated from orbit by less than half of its own diameter, bordered above by a fold of skin; fingers not webbed; webs between toes short, not involving more than the basal phalanx of the fourth toe; belly granular.

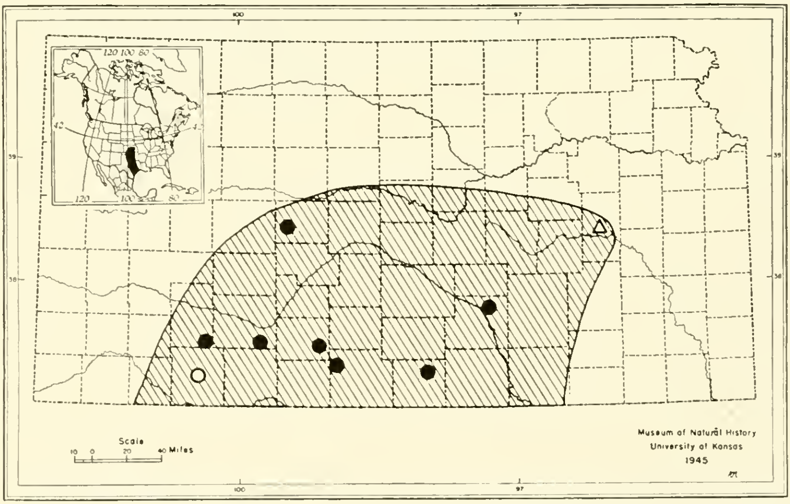


FIG. 54. Distribution of the spotted chorus frog, *Pseudacris clarkii*, in Kansas, with insert showing range of the species.

Light slate above, with promiscuously placed, rather large to medium-sized spots, usually not arranged in longitudinal rows; usually a triangular dark mark between eyes; limbs banded except on concealed and ventral surfaces; venter immaculate, whitish.

Size small, maximum snout-vent measurement being 1¼ inches.

Recognition Characters.—The combination of absence of extensive webs on the hind feet with the presence of a distinct tympanum is absolutely distinctive of the members of the genus *Pseudacris* in Kansas. *Gastrophryne* lacks the webs too but also lacks a visible tympanum. The two species of *Pseudacris* known from the state closely resemble each other, but can be distinguished by the following characters:

P. clarkii	*P. nigrita*
1. Upper lip not or feebly dark-edged.	1. Upper lip distinctly dark-edged.
2. A triangular dark mark between eyes.	2. Usually no triangular dark mark between eyes.
3. Usually with a pattern of irregularly distributed spots, but sometimes striped.	3. Always striped or with spots arranged in distinct rows.
4. Tympanum larger and in contact or near-contact with angle of jaws.	4. Tympanum smaller and more widely separated from angle of jaws.
5. Eggs deposited in clumps of 20 or less.	5. Eggs deposited in clumps of 110 or more.

In the two species the calls are different and the tadpoles are known to differ in various structural details.

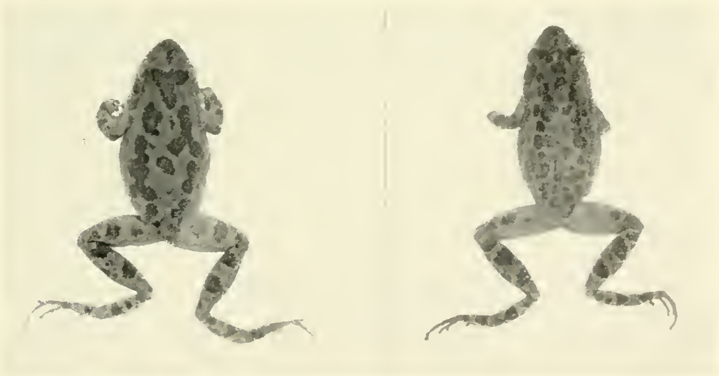


FIG. 55. Spotted chorus frogs, *Pseudacris clarkii*. × 1, from 2 miles north of Lexington, Cleveland County, Oklahoma. After Smith (1934).

Habits and Habitat.—This species is characteristic of grassland prairies. "In springtime, it emerges early in the evening to feed, ranging through pastures and fields but never in roadways except quite incidentally. It does not frequent stream margins or pools (except, of course, for breeding) and is quite secretive and shy. . . . In late summer (mid-July through September) I have never found *P. clarkii* active (except in late breeding congresses) and I think that, like the characteristic prairie bufos, they tend to be inactive during dry, hot weather." (Bragg, 1943: 130.)

Mating occurs in temporary, shallow pools, never in deep pools. An important environmental factor in bringing about breeding activities is rainfall; after the first heavy rains of spring (providing a certain undetermined minimum of moisture has previously fallen), the frogs come to the breeding sites. They breed at temperatures of as low as 5.5° C., and as early as March 5. If the spring is unusually dry, the breeding is delayed indefinitely, apparently with no ill effects, at least into August.

The call normally is a "loud, medium pitched, and rapidly repeated 'whank, whank, whank'" (Bragg, 1943: 131). However, the species has a surprisingly varied vocal repertoire, as discovered by Bragg. At temperatures below 12° C. the call is a slow grinding note, and when males approach a pond in which the species breeds they use a call not quite so loud as normal that has "an indescribable quality which, for want of a better term, I call 'pensive' or 'pleading.'" The latter calls presumably guide more distant males to the pools, and do not serve primarily to attract females.

Amplexation is axillary, and is maintained for periods of up to twenty-four hours. The pair moves about, chiefly through efforts of the female, as eggs are laid in small masses here and there usually on vertical grasses, sedges or weed stems not more than three inches below the surface of the water. Occasionally the pair comes to the surface for air. Approximately 1,000 eggs are laid, in masses of 6 to 30. They have been described in detail by Bragg (1933: 133). They require a higher concentration of oxygen than do the eggs of most kinds of frogs, which fact may explain why the eggs are deposited close to the surface of the water. They hatch, by disintegration of the gelatinous envelopes, in 2½ to 3 days. The tadpole has been described by Bragg (1943: 136-139).

After transformation the young frogs "remain near the pool for about three or four days, then gradually scatter widely. While about the pool, the young are diurnal except in very hot, bright sunshine. In the latter situation, they seek protection beneath any appropriate object during the day and come forth at night to feed." (Bragg, 1943: 139.)

Kansan Subspecies.—No subspecies of this species have been defined anywhere in its range.

References.—Smith, 1934: 462-465, map 15, fig. 24 (description); Bragg, 1943: 70-74 (natural history, compared with that of *P. nigrita*); Bragg, 1943: 129-140, figs. 1-4 (life-history).

Striped Chorus Frog

Pseudacris nigrita (Le Conte)

Rana nigrita Le Conte, Ann. Lyc. Nat. Hist., New York, vol. 1, pt. 2, 1825, p. 282 (type locality—Liberty County, Georgia).
Pseudacris nigrita Günther, Cat. Batr. Sal. Brit. Mus., 1858, p. 97.

Range.—The eastern two-thirds of the state. The western limit of range is not accurately known; the species has been taken as far west as Hays, Ellis County; Nekoma, Rush County; Pratt, Pratt County; and Kiowa, Barber County. In the northern part of the state it probably occurs as far west as Decatur County, yet has not been taken west of Miltonvale, Cloud County.

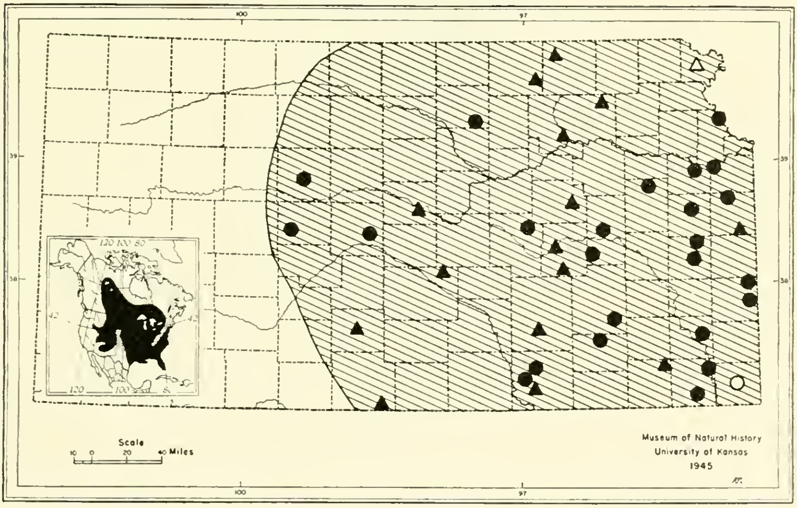


FIG. 56. Distribution of the striped chorus frog, *Pseudacris nigrita*, in Kansas, with insert showing range of the species.

Description.—Skin perfectly smooth; head rather flat; tympanum round, bordered above by a fold of skin, separated by one-third of its own diameter from angle of jaws, and by about three-fourths of its diameter from orbit; fingers not webbed; webs between toes very short; belly granular.

Color light slate above; typically three broad dark slate stripes down back; middorsal stripe frequently broken, others less frequently; rarely a triangular dark mark between eyes; a dark spot covering each eyelid frequently present; transversely elongate spots on limbs; feet usually pigmented; ventral surfaces whitish; a few small black spots usually present on chest.

Size small, the snout-vent length reaching 1½ inches.

Recognition Characters.—See discussion of *P. clarkii.*

Habits and Habitat.—The usual habitat of this species of frog is swampy, marshy places, and in such places the animals are abundant in spring. At this time of the year they may be found about temporary pools at roadsides or in pastures, or in small streams, although never, probably, as abundantly as along the shores of lakes and in flood plains. In summer and fall they seldom or never sing, and in these seasons are rarely found.

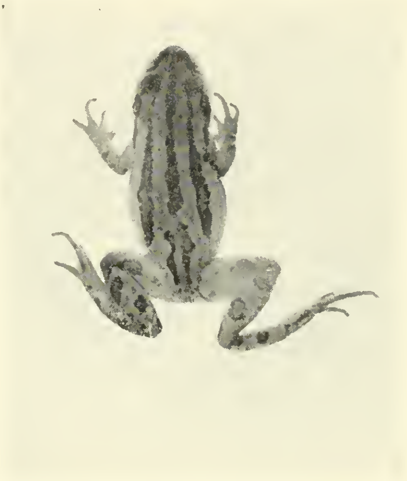


FIG. 57. A striped chorus frog. *Pseudacris nigrita triseriata,* × 1⅓, K. U. no. 23620, from 1 mile northeast of Riverton, Cherokee County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Because they lack extensive webs between the toes, they are not strong swimmers, and because the disks on the digits are small, the animals seldom climb far above the water.

The breeding season extends through March and April. Amplexation is axillary. The call may be imitated by drawing a point across a comb, commencing at the bottom of a jar and rapidly bringing it to the mouth. Approximately two months are required for complete development from the egg to the time of transformation.

The food consists of many kinds of arthropods, including a large percentage of spiders and beetles.

Kansan Subspecies.—The subspecies occurring in Kansas is *P. n. triseriata* (Wied), the type locality of which is Mt. Vernon, Ohio River, Indiana. Five other subspecies occur in the eastern United States and central Canada.

References.—Smith, 1934: 465-469, map 16 (description, natural history); Bragg, 1943: 70-75 (natural history, comparisons with *P. clarkii*); P. W. Smith, 1952: 165-180, pl. 1, figs. 1-2 (taxonomy).

Genus *Hyla* Laurenti

Spring Peeper

Hyla crucifer Wied

Hyla crucifer Wied, Reise Nord. Amer., vol. 1, pt. 5, 1838, p. 275 (type locality—Leavenworth, Kansas).

Range.—Extreme eastern Kansas. Recorded only from Leavenworth, Leavenworth County, Pigeon Lake, Miami County and 2 miles south of Galena, Cherokee County.

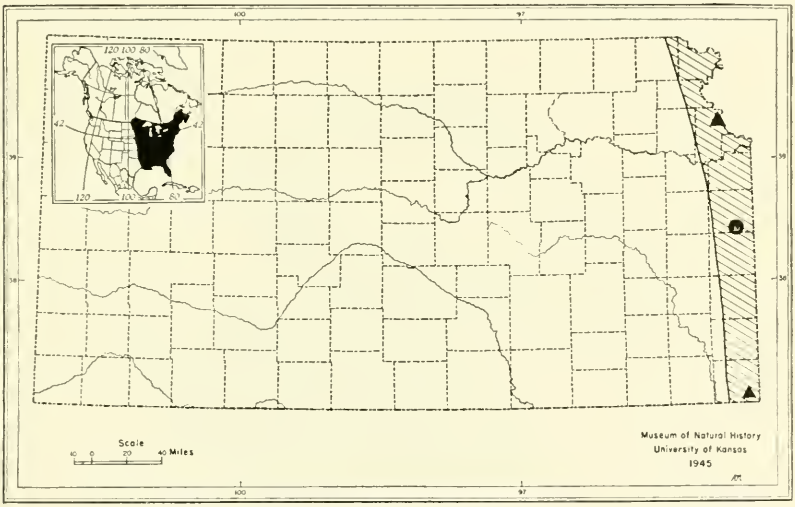


FIG. 58. Distribution of the spring peeper, *Hyla crucifer*, in Kansas, with insert showing range of the species.

Description.—Skin perfectly smooth; no parotoid glands; tympanum distinct, round, its diameter about two-thirds internarial distance, removed from angle of jaw by about one-half its length, from orbit by about three-fourths; largest disk on fingers but slightly smaller than tympanum; a distinct metatarsal tubercle and tarsal fold; no webs on fingers; webs on toes extending to antepenultimate phalanx of fourth toe, to penultimate of others; ventral surfaces granular.

Color above light brown, with darker, brownish, narrow markings forming a band between eyes, a cross extending from eyes to the midlumbar region, and an inverted v-shaped mark in front of anus; frequently a band connecting the arms of the cross; limbs narrowly banded; ventral surfaces yellowish, immaculate.

Size small, the snout-vent measurement reaching 1¼ inches.

Recognition Characters.—This is the only genus of amphibian in Kansas the fingers of which terminate in disks the largest of which are nearly or quite as large as the distinct tympanum. The two species of this genus differ as follows:

H. crucifer	*H. versicolor*
1. Ground color brownish.	1. Ground color greenish, slate or gray.
2. A distinct, narrow-lined cruciform mark on back.	2. Markings irregular, seldom cruciform.
3. Webs between toes extending only to penultimate phalanges (antepenultimate on 4th).	3. Webs between toes extending to terminal disks (to ultimate phalanx on 4th).

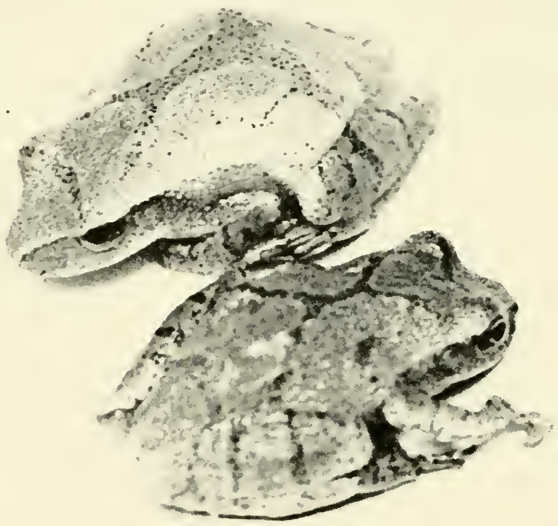


FIG. 59. Spring peeper, *Hyla c. crucifer*, × 2, from 3 miles northeast of Valmeyer, Monroe County, Illinois.

Habits and Habitat.—This species occurs in marshes, swamps, ditches, ponds, any pools (whether temporary or permanent), in timbered areas and in untimbered lowlands.

The breeding season is early—March 15 to March 24 in Kansas, so far as known. Amplexation is axillary. The song is a series of half-second peeps, repeated ten to twenty times at intervals of one minute or so. The sound has the quality of a high shrill whistle. In chorus the effect is that of jingling sleigh bells (see p. 89).

The eggs hatch in 4 to 5 days, and transformation requires 90 to 100 days.

The food consists of such nonaquatic insects as bugs, flies, and beetles with a predominance of flying kinds.

Kansan Subspecies.—*H. c. crucifer* occurs in Kansas. The only other subspecies recognized occurs in the extreme southeastern United States.

References.—Smith, 1934: 470-472, map 17, fig. 26 (description, natural history); Wright and Wright, 1949: 311-315, pl. 66, map 23 (general account).

Common Tree Frog

Hyla versicolor Le Conte

Hyla versicolor Le Conte, Ann. Lyc. Nat. Hist., New York, vol. 1, pt. 2, 1825, p. 28 (type locality—New York, New York).

Range.—Eastern third of Kansas. Recorded from as far west as Manhattan, Riley County; Fall River, Greenwood County; and Elk City, Montgomery County.

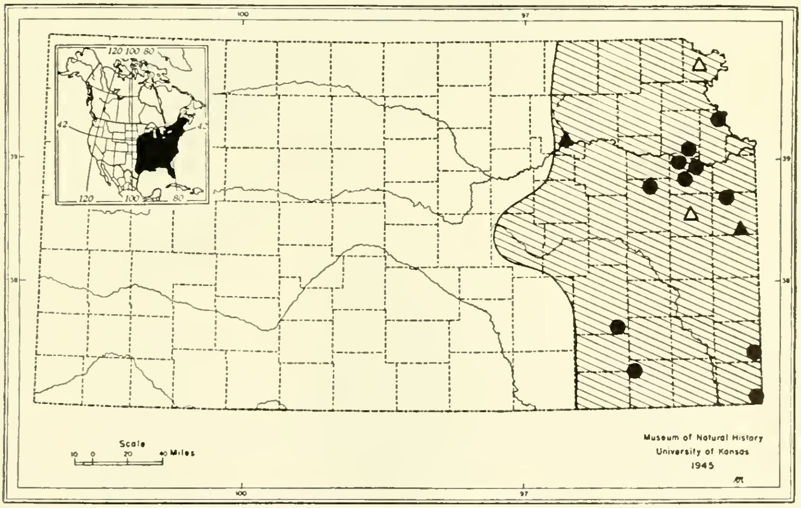


FIG. 60. Distribution of the common tree frog, *Hyla versicolor,* in Kansas, with insert showing range of the species.

Description.—Skin perfectly smooth; no parotoid glands; tympanum distinct, large, round, its diameter slightly less than internarial distance, separated from angle of jaws by one-fourth to one-fifth its own diameter, and almost in contact with orbit; fingers slightly webbed; digital disks large; a large inner metatarsal tubercle; toes nearly fully webbed; ventral surfaces granular.

Color above normally light gray, but back with darker gray, black-outlined markings, frequently forming a bluntly five-pointed irregular star-shaped mark in pectoral region; a band across each upper eyelid; a dark line from posterior margin of eye to groin, limbs broadly banded; posterior concealed surface of thighs reticulated or blotched with darker color; concealed surfaces of thigh, shank and groin orange in life.

Size moderate, the snout-vent measurement amounting to as much as 2⅖ inches.

Recognition Characters.—See discussion of *H. crucifer.*

Habits and Habitat.—These animals are restricted to permanent, wooded bodies of water, such as lakes, permanent swamps, and streams. Although they seldom leave the vicinity of these permanent bodies of water, they are not actually in them, except during the breeding season, but remain in the trees, shrubs and sometimes on the ground, from where males call in summer and fall. Prior to the

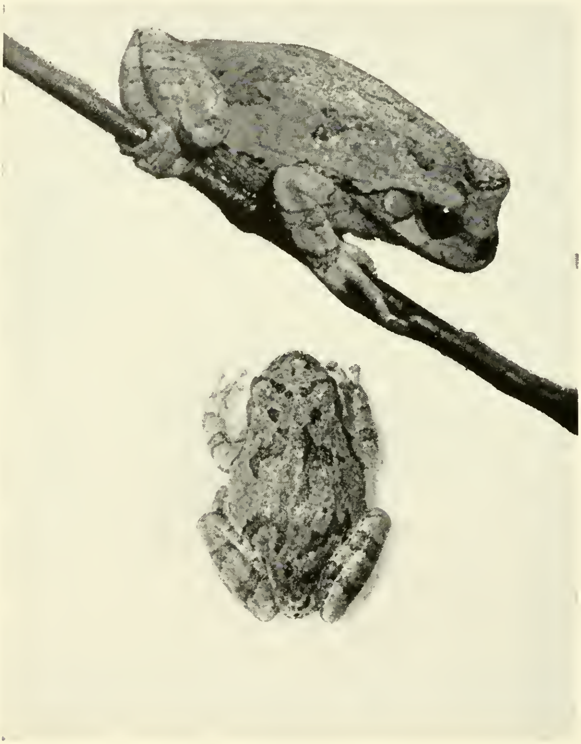


FIG. 61. Common tree frogs, *Hyla v. versicolor.* Top from Pigeon Lake, Miami County, Kansas, × 1¼; courtesy H. K. Gloyd. Bottom from 4 miles north and 1 mile east of Lawrence, Douglas County, Kansas, × ¾; photo by W. W. Tanner and T. P. Lyle.

actual breeding season they remain in these situations for periods of up to ten days.

Males are heard as early as April 9 in Kansas, and mating occurs as late as June. At temperatures of 50° F. or less they do not call or breed. The eggs are laid in packets of thirty to forty, and from a single female total up to about 1,800. Amplexation is axillary. The call is a loud, pronounced trill of approximately two seconds duration, repeated at intervals of ten to twenty seconds.

Kansan Subspecies.—The subspecies of Kansas is *H. v. versicolor.* Two other subspecies, *H. v. chrysoscelis* Cope and *H. v. sandersi* Smith and Brown, are recognized. They occur in Texas and Louisiana northward to Illinois.

References.—Smith, 1934: 472-477, map 18, fig. 28 (description, natural history); Bragg, 1943: 64-67 (natural history).

FAMILY RANIDAE

Genus *Rana* Linnaeus

Gopher Frog

Rana areolata Baird and Girard

Rana areolata Baird and Girard, Proc. Acad. Nat. Sci. Phila., vol. 6, 1852, p. 173 (type locality—Indianola, Texas).

Range.—Southeastern fifth of the state. Known as far west as 9 miles southeast of Toronto, Greenwood County, and 6¾ miles northeast of Howard, Elk County; and as far north as Lawrence, Douglas County.

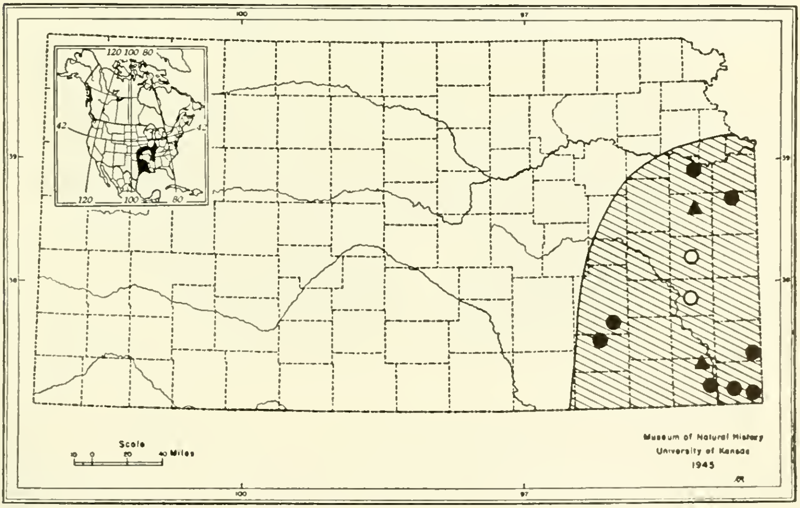


FIG. 62. Distribution of the gopher frog, *Rana areolata,* in Kansas, with insert showing range of the species.

Description.—Skin on sides with smooth warts; no parotoid glands; tympanum distinct, round, separated from eye by one-half its own diameter, which is about two-thirds diameter of eye; fingers not webbed; toes webbed to antepenultimate phalanx of fourth digit, to penultimate or ultimate phalanges of others; no blackened tubercles on hands or feet; a pair of prominent dorsolateral ridges extending posteriorly to level of groin; short longitudinal ridges present between dorsolateral ridges.

Color light slate or light brown above; back with numerous, dark bluish, blue-brown or darker brown, more or less rounded, usually light-edged, sometimes light-centered, spots over body and head, smaller on latter; a distinct dark reticulation between these dark

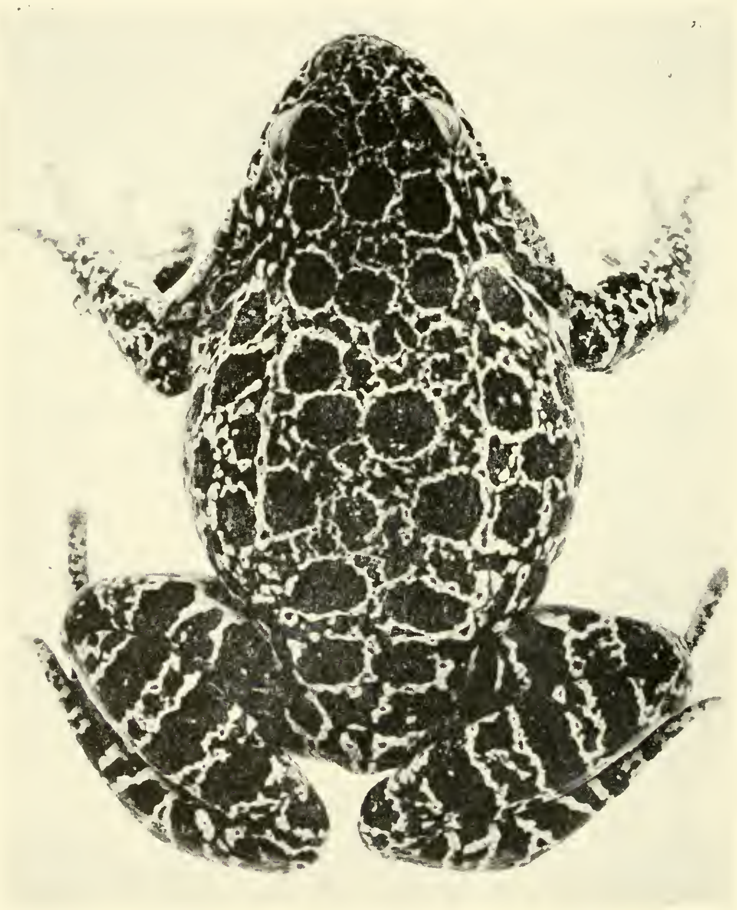


FIG. 63. A gopher frog, *Rana areolata circulosa*, × 1, from Haskell Bottoms, 2 miles south of Lawrence, Douglas County, Kansas. After Smith (1934).

spots on back; posterior limbs with about four dark cross-bands; forelimbs blotched. Ventral surfaces immaculate, whitish.

Size moderately large, maximum snout-vent length, 4¹⁄₁₆ inches.

Recognition Characters.—The presence of distinct dorsolateral ridges combined with a pattern of large, round dark spots, distinguishes this species from all others in Kansas except *R. pipiens*. From the latter it differs most clearly in having (whereas *R. pipiens* lacks) a dark reticulation between the dark spots on the back.

Habits and Habitat.—These frogs generally are found in low meadow land, in crayfish holes, and seldom leave the holes except in the spring, when breeding choruses form in temporary pools. Except during the breeding season, the frogs are rarely seen. They presumably live in the crayfish holes throughout the year, and wander but short distances from them, emerging only in early morning.

They breed as early as March 11 and as late as May 15. The calls are short, one or two seconds in duration. Some 7,000 eggs are laid in masses five or six inches in diameter. The larvae are undescribed except for the mouthparts.

Juvenal individuals are extremely rare in collections. Apparently they utilize burrows immediately upon transformation. If it were not for the annual breeding congresses, adults undoubtedly would be as rarely found as are the juveniles. No other species of *Rana* in this country possess such secretive habits. In the postbreeding season, specimens can be dug from their retreats, but a more effective and less tedious method is to probe into crayfish holes with a slender stick to the end of which is attached a small fishhook. Holes occupied by frogs can be identified by the absence of an earthen funnel and the presence of a smooth platform beside the entrance.

The vocal sacs of males are paired and are distended, when the song is produced, to a size almost equal to that of the head.

Equally as unique as the habitat, so far as species of *Rana* in this country are concerned, are (1) the formation of breeding congresses in response only to heavy rains, and (2) utilization by the congresses of temporary pools. These features identify the xeric (arid) type of breeding pattern, and suggest that in the distant past the frogs were subject to much more arid conditions than they now are.

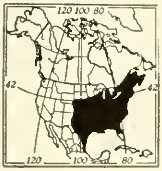
Kansan Subspecies.—The subspecies occurring in Kansas is *Rana areolata circulosa* Davis and Rice, with type locality at Olney, Richland County, Illinois. The only other subspecies, *R. a. areolata,* occurs to the south, in Texas, Oklahoma, Arkansas and Louisiana.

References.—Smith, 1934: 477-482, map 19, fig. 31; Bragg, 1953 (breeding behavior, eggs, tadpoles); Goin and Netting, 1940: 153-158 (taxonomy, natural history).

Bullfrog

Rana catesbeiana Shaw

Rana catesbeiana Shaw, Gen. Zoöl., vol. 3, pt. 1, 1802, p. 106, pl. 33 (type locality—Charleston, South Carolina).



Range.—Presumably state-wide; not recorded in extreme southwestern corner.

Description.—Skin smooth; no parotoid glands; tympanum distinct, round to oval, its diameter twice internarial distance in males, equal in females; fingers not webbed; toes fully webbed, terminal phalanx of 4th toe sometimes partly free; no blackened tubercles on hands or feet; no dorsolateral ridges, although tympanum is bordered above by a fold.

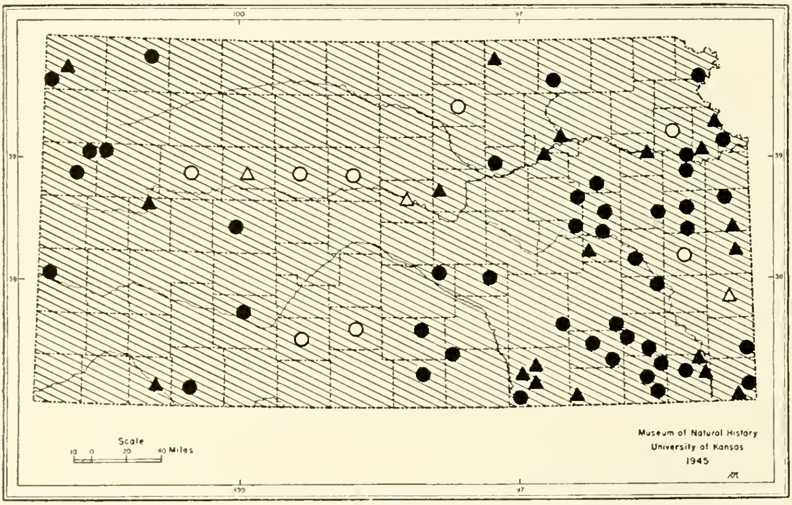


FIG. 64. Distribution of the bullfrog, *Rana catesbeiana*, in Kansas.

Color above green or olive to brownish, either uniform or indistinctly blotched with darker; hind legs usually indistinctly banded or spotted; if the latter, spots arranged in transverse rows; venter whitish or obscurely mottled with dark color, especially on chest and throat; concealed surfaces of shank and thigh heavily mottled or reticulated. Young and larvae with numerous scattered, minute, black specks above.

Size large, the snout-vent length reaching eight inches.

Recognition Characters.—This can be distinguished from all other species of *Rana* in Kansas by the complete absence of dorsolateral folds; all others have them extending at least halfway to the groin. From other species of anurans in Kansas it may be distinguished by the following combination of characters: smooth skin, lacking parotoid glands (excludes *Bufo*); absence of a blackened tubercle with a free cutting edge at base of foot (excludes *Spea*); presence of complete webs between toes, with no more than the last phalanx of the fourth toe free from web (excludes *Pseudacris* and *Gastrophryne*); and absence of disks at the tips of the digits (excludes *Hyla*).

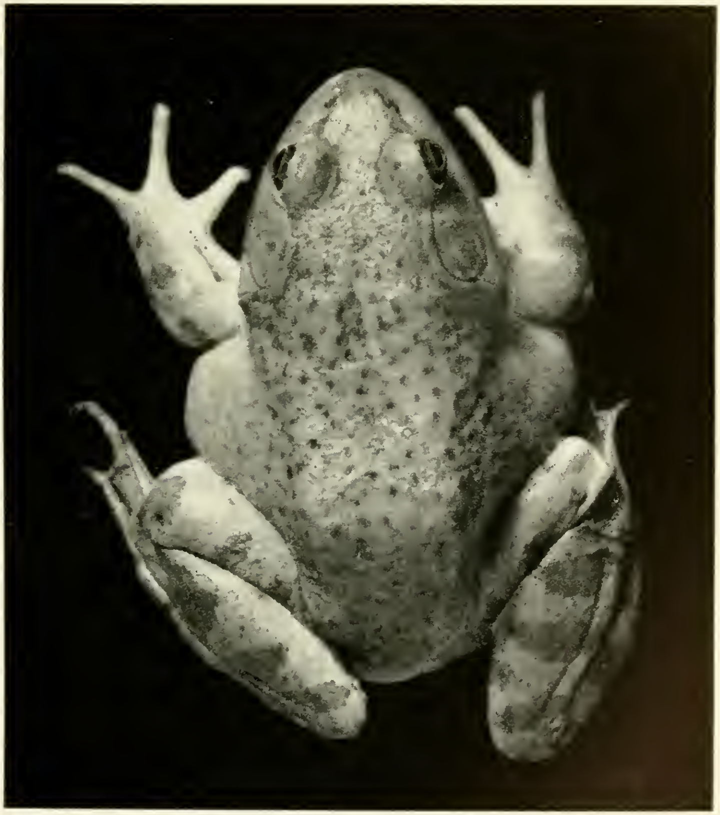


FIG. 65. A bullfrog, *Rana catesbeiana*, × ⅔, from 2 miles north and 1 mile east of Lawrence, Douglas County, Kansas. Photo by W. W. Tanner and T. P. Lyle.

Habits and Habitat.—These frogs are restricted to permanent bodies of water such as lakes, rivers and swamps with deep water. Isolated ponds may be inhabited if the water is permanent. Introduced into cattle tanks, they appear to live well.

Dispersal by man has resulted in establishment under natural conditions of the species in areas as remote as eastern Mexico and California, whereas the natural range seems to have been restricted to the eastern United States. In a few decades the former natural range may well become completely obscured.

The period of hibernation is probably passed under water. Emergence occurs as early as February 16, but mating follows much later, certainly in May. The eggs are laid in large films of 10,000 to 20,000 eggs each and one film covers one to two and one-half square feet; the eggs hatch in four to five days. The larvae typically require one year for transformation, which occurs late in the second summer after hatching.

The food is of great variety, including small vertebrates as well as arthropods. A goodly proportion is terrestrial.

Kansan Subspecies.—No subspecies have been defined anywhere in the range of this species.

References.—Smith, 1934: 482-487, map 20 (description, natural history); Wright and Wright, 1949: 444-449, pl. 94, map 29 (general account).

Green Frog

Rana clamitans Latreille

Rana clamitans Latreille, Hist. Nat. Rept., vol. 2, 1802, p. 157 (type locality—Charleston, South Carolina).

Range.—Extreme eastern Kansas south of the Missouri River. Recorded from only two counties: Miami (Marais des Cygnes River near Osawatomie) and Cherokee (Riverton and Shoal Creek 200 ft. from Missouri line, west of Baxter Springs).

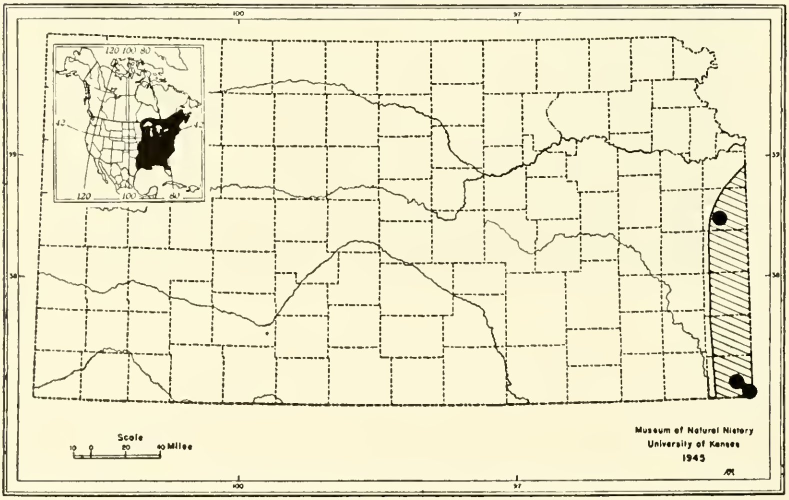


FIG. 66. Distribution of the green frog, *Rana clamitans*, in Kansas, with insert showing range of the species.

Description.—Skin with numerous smooth or spinose rugosities, except on head; rugosities on hind limbs sometimes arranged in longitudinal rows; no parotoid glands; tympanum distinct, in females separated from orbit and angle of jaws by one-half its diameter, which is one-third greater than internarial distance; tympanum in males with a diameter twice internarial distance and practically in contact with orbit and angle of jaws; fingers not webbed; toes fully webbed except for proximal phalanx of fourth toe; no blackened tubercles on hand or foot; dorsolateral ridges present, extending posteriorly only half the length of the back (to the sacrum, marked by the hump, at middle of back).

Color uniform olive or olive-brown; sometimes blackish blotches of indefinite outline scattered over back, sides and top of head; limbs sometimes narrowly banded; posterior surfaces of thighs reticulated or heavily marbled with blackish, or almost uniform blackish or gray with minute light spots; throat sometimes faintly blotched with gray, venter otherwise white, immaculate.

Size moderate, snout-vent measurement reaching four inches.

Recognition Characters.—The presence of dorsolateral folds extending halfway down the back is distinctive of this species. The complete absence of distinctly outlined dark spots is characteristic, but *R. catesbeiana,* as well as each of several other species, is similar in this respect.

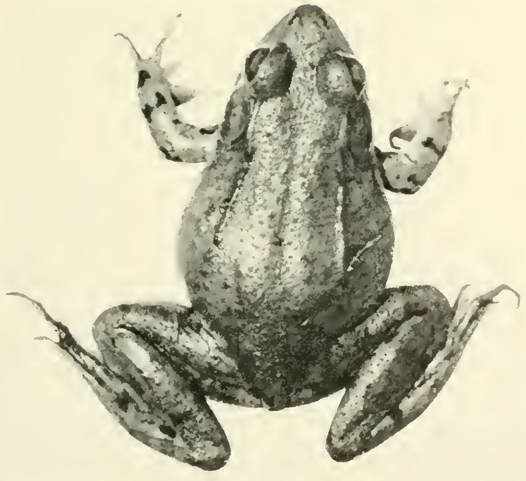


FIG. 67. A green frog, *Rana clamitans clamitans,* × ½, from Callahan, Florida. Courtesy A. A. and A. H. Wright.

Habits and Habitat.—This solitary frog, like *R. catesbeiana,* is restricted to permanent pools or streams. In Kansas the breeding habits are unknown. Elsewhere it emerges in April, and breeding follows much later. The larvae typically transform about three months after hatching. The call is a twanging bass note repeated at intervals of some thirty seconds.

The life history of northern individuals has been studied in detail. Nothing is known of the life history of individuals in the central and southern parts of the range, where transformation may be expected to occur in the first year, without overwintering in the tadpole stage. It is reliably recorded that a similar abbreviation occurs in the life history of the bullfrog, in which transformation requires two years in the north and only one in the south.

Ovulation (egg-laying) occurs in a period of about three weeks at any time in a period of two and one-half months in the north, but whether such an extended period holds in the central part of the range is unknown. Details of all parts of the life history of individuals in Kansas and in more southern areas are to be desired for comparison with those of individuals from more northern areas.

The food is ninety percent nonaquatic, consisting of worms and various arthropods such as insects, crayfish and spiders.

Kansan Subspecies.—Two subspecies are recognized. The one occurring in Kansas is *Rana clamitans melanota* (Rafinesque), with Lake Champlain as type locality. It ranges northward from southern Oklahoma, southern Illinois and the coastal plain into Canada.

References.—Smith, 1934: 488-491, map 2 (description, natural history); Mecham, 1954: 1-24, figs. 1-7, pl. 1 (taxonomy); Wright and Wright, 1949: 450-454, pl. 95, map 30 (general account).

Pickerel Frog

Rana palustris Le Conte

Rana palustris Le Conte, Ann. Lyc. Nat. Hist., New York, vol. 1, pt. 2, 1825, p. 282 (type locality—Philadelphia, Pennsylvania).

Range.—Extreme southeastern Kansas. Recorded only from Cherokee (3 to 5 miles north of Baxter Springs) and Crawford (Cow Creek, Pittsburg) counties.

Description.—Skin with a pair of broad dorsolateral ridges extending posteriorly to level of groin; a number of short longitudinal ridges between folds; tympanum distinct, round, sometimes bordered above by a fold of skin and separated from tympanum and angle of jaws by about one-third its own diameter; fingers not webbed; toes nearly fully webbed but deeply indented, the two terminal phalanges of fourth toe free or with a narrow flap bordering each side; metatarsal tubercles present but not blackened.

Color above tan or light brown; rectangular, definitely outlined, sometimes narrowly light-bordered dark reddish-brown spots, arranged in two more or less regular rows between the dorsolateral ridges and also in two rows on the sides, the lower row of much smaller spots; forelegs blotched above, hind legs narrowly banded; dorsolateral ridges sometimes silvery; posterior surfaces of thigh blotched; concealed surfaces of thigh and groin orange; ventral surface whitish, unmarked or with a few spots on lower lips.

Size moderate, the snout-vent measurement reaching 3⅙ inches.

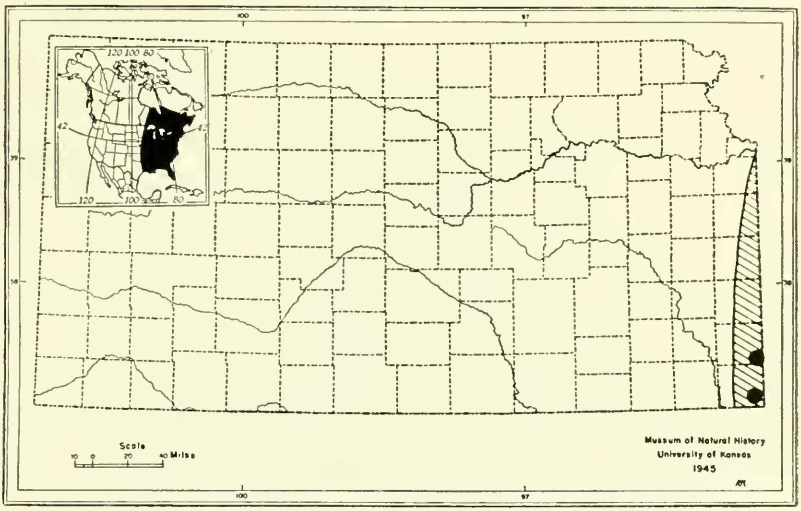


FIG. 68. Distribution of the pickerel frog, *Rana palustris,* in Kansas, with insert showing range of the species.

Recognition Characters.—The presence of dorsolateral ridges extending posteriorly to the level of the groin distinguishes this species from all other anurans of the state with the exception of *R. areolata, R. pipiens* and *R. sylvatica.* The latter has no distinctly outlined spots, and is thus easily separable from *R. palustris,* but the first two do have spots. From *R. areolata* and *R. pipiens, palustris* differs chiefly in the presence of rectangular instead of round or oval spots, the arrangement of them in regular rows, and in the presence of an orange color on the concealed surfaces of the flank and thigh.

Habits and Habitat.—This species frequents cold springs, permanent, clear streams, ponds, lakes and the like, where vegetation at the water's edge is sufficient for concealment. Among the species of the genus *Rana* of the United States, *palustris* is exceptional in its ability to secrete an irritating fluid poisonous in the digestive tract of other animals. These secretions will kill other amphibians if they are kept in close confinement with *R. palustris,* and are very dangerous to man if eaten.

No details of the life history in Kansas are known, but elsewhere the eggs, 2,000 to 3,000 in number, are laid in masses 3½ to 4 inches in diameter, and hatch in 11 to 21 days. The larvae transform 90 to 100 days after hatching.

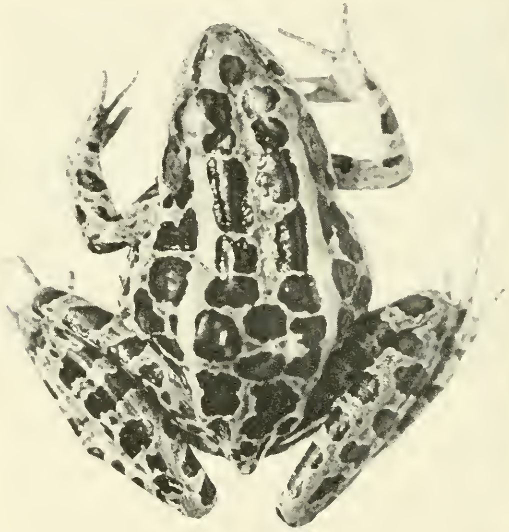


FIG. 69. A pickerel frog, *Rana palustris,* × ¾. Courtesy A. A. and A. H. Wright.

A vast variety of arthropods is eaten. Recently transformed individuals have a diet of 76 percent terrestrial forms, whereas in adults 95 percent of the food is terrestrial, in large part as a result of the thickened skin allowing a wider forage range.

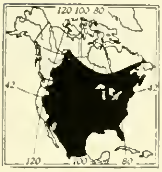
Kansan Subspecies.—No subspecies have been defined anywhere in the range of this species.

References.—Smith, 1934: 491-494, map 22 (description, natural history); Wright and Wright, 1949: 476-480, pl. 100, map 32 (general account).

Leopard Frog

Rana pipiens Schreber

Rana pipiens Schreber, Naturforscher, vol. 18, 1872, p. 185, pl. 4 (White Plains, New York, or Raccoon Landing, Gloucester County, New Jersey).



Range.—State-wide.

Description.—A pair of dorsolateral ridges extending posteriorly to groin; usually short ridges present between dorsolateral ridges; no parotoid glands; tympanum with a diameter equal to or somewhat greater than internarial distance, separated by one-fourth its diameter from orbit, by one-sixth from angle of jaws; fingers not webbed; toes nearly or fully webbed, except two terminal phalanges on fourth toe, which are bordered by a narrow flap of skin extending from web; a distinct tarsal fold; metatarsal tubercles present but not blackened.

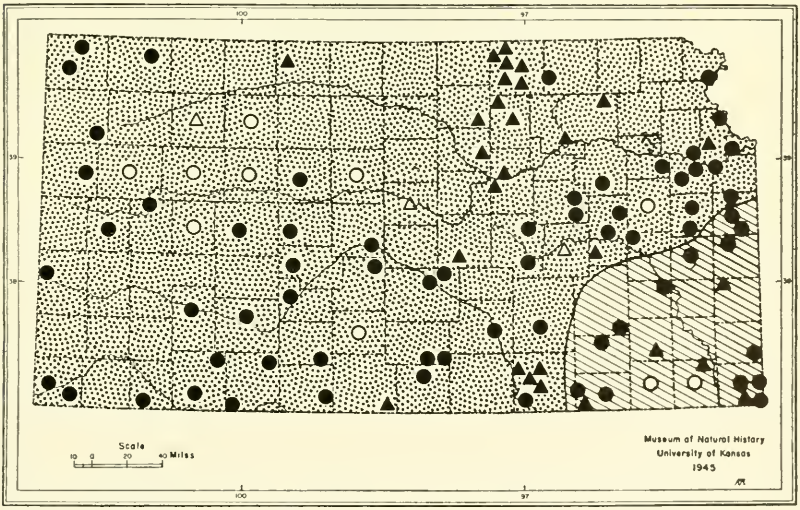


FIG. 70. Distribution of the leopard frog, *Rana pipiens*, in Kansas. The range of *R. p. berlandieri* in the eastern part of the state is indicated by the lined area and that of *R. p. brachycephala* by the stippled area.

Color above slate; brownish gray to dark gray or blackish spots on back and sides; bands or spots on hind legs; frequently a light band along dorsolateral ridges, and from above axilla below tympanum and eye onto side of head; in some specimens (especially southeastern), a distinct dark stripe extends from orbit through nares to tip of snout, the light line below encroaching upon the former and not narrowly restricted; ventral surfaces immaculate save for markings about edge of lower jaw; posterior surface of thigh spotted or reticulated with darker.

Size moderate, the snout-vent measurement reaching 4 1/12 inches.

Recognition Characters.—Only three species of frogs in Kansas possess a pair of dorsolateral folds extending to groin, combined with distinctly outlined dark spots: *R. areolata, R. palustris,* and *R. pipiens.* For comparisons of the latter with the former two see discussions of *R. areolata* and *R. palustris.*

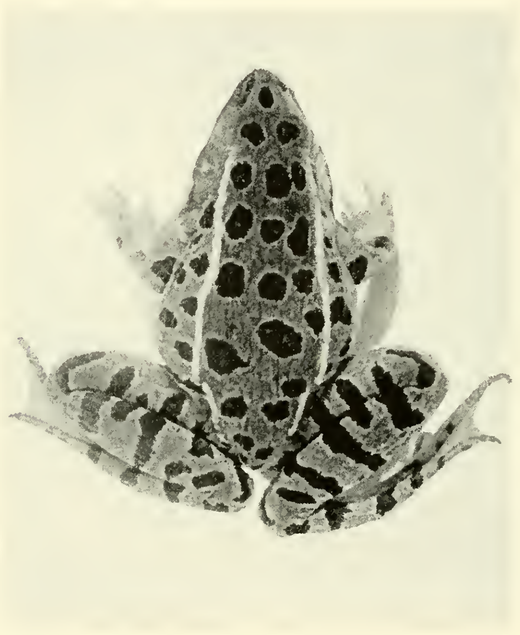


FIG. 71. A leopard frog, *Rana pipiens brachycephala,* × 1, from Lawrence, Douglas County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Habits and Habitat.—The leopard frog is the most ubiquitous of the anurans of the state. Practically every roadside pool, stream, pond, lake, swamp and river has its quota, especially during the breeding season and early summer, when transformation takes place. During much of the year specimens may be found in damp situations far from water.

Hibernation takes place in mud and water at depths below the frost line. The frogs emerge as early as February 2. Breeding has been reported as early as March 10, and may continue until the middle of May. The song is a low chuckling of varied frequency.

The eggs, 4,000 to 6,500 in number, are laid in masses four to five inches in diameter and hatch in five to twenty days. In approximately three months the larvae transform.

The food consists almost wholly of nonaquatic arthropods.

Kansan Subspecies.—Two races, *Rana pipiens berlandieri* Baird (with type locality in southern Texas) and *R. p. brachycephala* Cope (with type locality on Yellowstone River), occur in Kansas. There are a number of differences between these two races in Kansas, the most reliable of which is the ratio of head length to head width. The latter divided by the former is 1.1 or more in *R. p. brachycephala* and less than 1.1 in *R. p. berlandieri.* Not only is the southeastern race more narrow-headed, but in it the longitudinal bands on the front of the thigh are indicated at least by a row of spots (entirely absent in *R. p. brachycephala*); a spot is rarely present on top of the snout in front of eyes (usually present in *R. p. brachycephala*); and distinct bands are present on each side of the head from the eyes to the tip of the snout (absent or indistinct in *R. p. brachycephala*).

References.—Smith, 1934: 494-501, map 23 (description, natural history); Wright and Wright, 1949: 498-520, pls. 105-115, map 34 (general account).

Wood Frog

Rana sylvatica Le Conte

Rana sylvatica Le Conte, Ann. Lyc. Nat. Hist., New York, vol. 1, pt. 2, 1825, p. 282 (type locality—New York, New York).

Range.—Limits unknown in Kansas. Apparently a relict form, known at present only from the Verdigris River bottoms in extreme southwestern Lyon County.

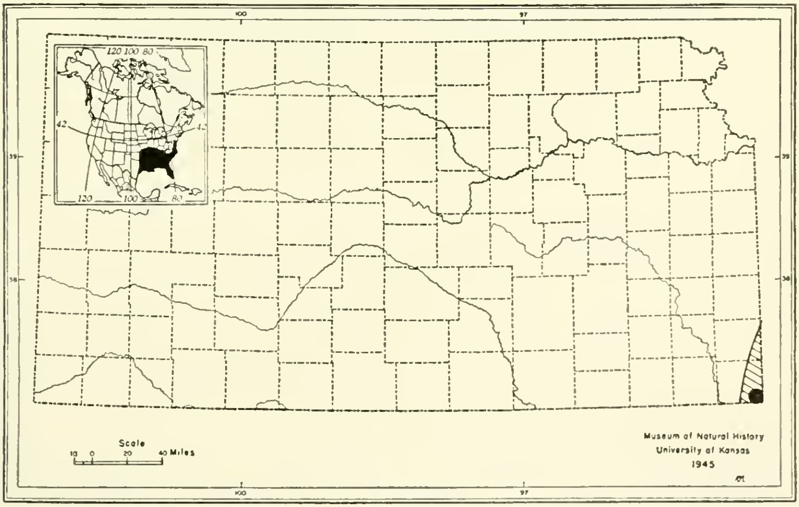


FIG. 72. Distribution of the wood frog, *Rana sylvatica,* in Kansas, with insert showing range of the species.

Description.—Dorsolateral ridges extending to level of groin; skin with small, smooth irregularities giving it a somewhat rough appearance; no parotoid glands; tympanum distinct, its diameter entering body length 11 to 15 times; no blackened tubercles on hands or feet; fingers not webbed; toes fully webbed, except on fourth toe.

Color brownish above, usually uniform and unspotted, but sometimes a median white stripe present, and/or a dark area down middle of back bordering the stripe if present; hind legs with narrow dark bars; a prominent dark stripe on side of head from snout through eye and tympanum, bordered below by a broad white line; edge of upper lip dark; throat and chest usually speckled, ventral surfaces otherwise white.

Size rather small, the snout-vent measurement not exceeding 2¼ inches, tibia-body proportion .45 to .55; leg (to heel) equally as long as, or shorter than, body.

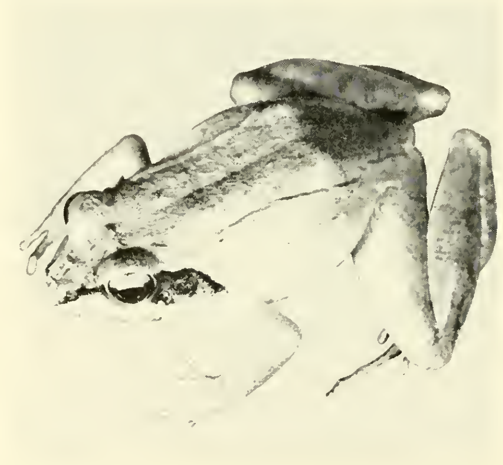


FIG. 73. A wood frog, *Rana s. cantabrigensis*, × 1, from Fox Ridge State Park, Coles County, Illinois. Photo by Charles A. McLaughlin.

Recognition Characters.—The combination of a dark patch on side of head (involving tympanum), absence of distinctly outlined spots on back, and presence of a pair of dorsolateral ridges extending to the level of the groin, is absolutely distinctive of this species in Kansas. *R. clamitans* and *R. catesbeiana* lack dorsal spots but the dorsolateral ridges are either absent or reach only halfway to the groin, and they lack the black patch on the side of the head. No other anurans closely resemble *R. sylvatica*.

Habits and Habitat.—This is strictly a woods frog, never found in open areas. Breeding occurs in woodland pools. Unlike other ranas of Kansas, it hibernates on land, under stumps, logs or stones.

The natural history of this frog in Kansas is unknown. Elsewhere it breeds from March to July at temperatures of some 50° F. The eggs, 2,000 to 3,000 in number, are laid in masses 2¼ to 4 inches in diameter. The larvae transform 44 to 85 days after hatching. The call is said to be a hoarse clacking.

Kansan Subspecies.—The subspecies reported in Kansas is *R. sylvatica cantabrigensis* Baird, with type locality at Moose Jaw, Saskatchewan. Two other subspecies are recognized. One, *Rana s. sylvatica* Le Conte, is to be expected in the extreme southeastern corner of Kansas. Its chief peculiarity is the long legs, whose length enters only .53 to .62 times into the snout-vent length, as opposed to .62 to .74 in *R. s. cantabrigensis;* the tibia-body proportion is greater, .55 or more, and the leg (to heel) is longer than the body.

References.—Wright and Wright, 1949: 540-552 (description, natural history); Schmidt, 1938: 377-379 (taxonomy).

FAMILY MICROHYLIDAE

Genus *Gastrophryne* Fitzinger

Eastern Narrow-mouthed Frog

Gastrophryne carolinensis (Holbrook)

Engystoma carolinense Holbrook, N. Amer. Herp., ed. 1, vol. 1, 1836, p. 83, pl. 11 (type locality—Charleston, South Carolina).

Gastrophryne carolinensis Stejneger and Barbour, Check List N. Amer. Amph. Rept., 1917, p. 40.

Range.—Extreme southeastern corner of the state. Recorded only from four miles east of Baxter Springs, Cherokee County, Kansas.

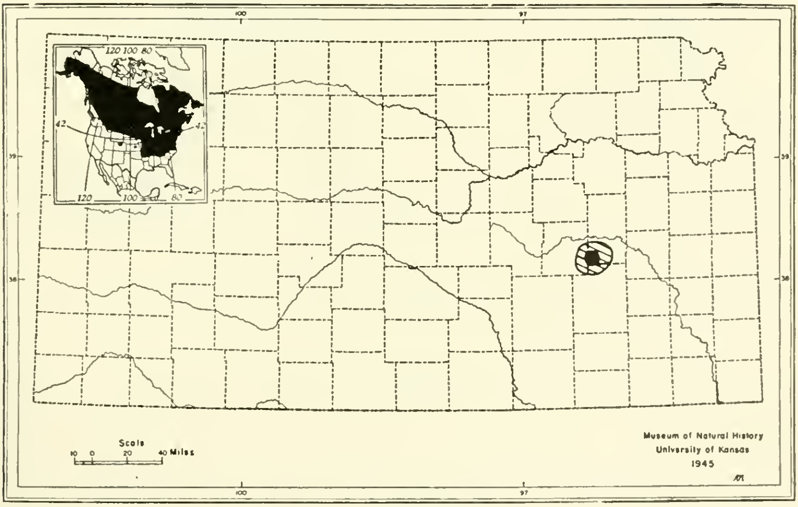


FIG. 74. Distribution of the eastern narrow-mouthed frog, *Gastrophryne carolinensis*, in Kansas, with insert showing range of the species.

Description.—Skin smooth; no parotoid glands; no tympanum visible; head narrow, pointed, considerably narrower than body; no webs on either fingers or toes; an inner but no outer metatarsal tubercle, not cornified; a transverse groove passing across head between posterior borders of orbits and extending onto each side of head behind angles of jaws, and sometimes completely encircling, the head; no tarsal fold; a groove across chest between armpits.

Color dark slate gray above; sides and broad middorsal area often darker than rest of body; irregular dark spots outline a middorsal area, whether this area is darker or not; the area generally narrower in front than behind, but very variable in shape; limbs with variable dark marks; ventral surfaces of body and limbs dark, with small, scattered, rounded light spots. In males the throat is dark.

Size small, maximum snout-vent measurement being 1⅜ inches.

Recognition Characters.—All other anurans in the state, except *Gastrophryne olivacea*, have at least short webs between the toes, and a distinct tympanum. The broad body and narrow, pointed head are likewise distinctive. This species possesses a heavily pigmented belly, whereas the belly in *G. olivacea* is unpigmented.

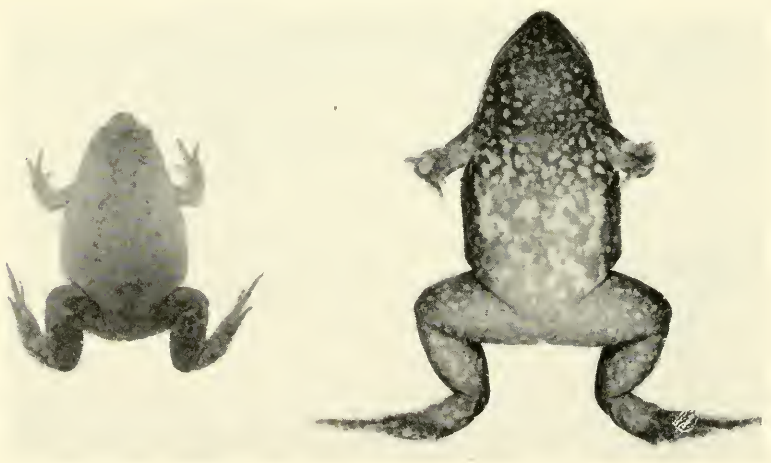


FIG. 75. Eastern narrow-mouthed frogs, *Gastrophryne carolinensis*. Left, K. U. no. 24414, 4 miles east of Baxter Springs, Cherokee County, Kansas, × $^{9}/_{10}$. Photo by E. H. Taylor and T. P. Lyle. Right, from southern tip of Matagorda Island, Matagorda County, Texas, × 1⅓. Photo by R. R. Hamm.

Habits and Habitat.—Wooded, moist regions are inhabited; there the animals are found most often either breeding about clear, temporary pools and backwater, or under surface debris. During dry periods they remain buried underground and are rarely seen.

In the breeding season, from April to August, the males call from terrestrial pools with a peculiar bleating voice quite like that of sheep. It is of low intensity, scarcely audible at a distance of fifty to seventy-five feet away. The call is short, lasting 1.5 to 2 seconds. The eggs and tadpoles are well known (see Wright, 1934). The egg mass is a surface film; in some instances the eggs are in separate packets of ten to ninety eggs each. The complement is about 850 eggs, the envelopes of which are truncate. The tadpoles are small (1 inch in length), flat and wide; the head is notably flattened, the snout is truncate, and the eyes are visible from below. The spiracle is immediately in front of the anus. There is no disk, or horny mandible, and there are no papillae, or horny teeth.

Kansan Subspecies.—No subspecies have been distinguished anywhere in the range of this species.

References.—Wright, 1931: 452-476, numerous illus. (complete account, Okefinokee Swamp, Georgia); Hecht and Matalas, 1946: 1-21 (taxonomic review); Carvalho, 1954: 12-13 (generic status).

Western Narrow-mouthed Frog

Gastrophryne olivacea (Hallowell)

Engystoma olivaceum Hallowell, Proc. Acad. Nat. Sci. Phila., vol. 8, 1856, p. 252 (type locality—Ft. Riley, Geary County, Kansas).
Gastrophryne olivacea Smith, Copeia, 1933, p. 217.

Range.—Eastern two-thirds of the state. Peripheral records to the west and north are in Meade (State Park), Rush (Nekoma), Ellis (6 miles west of Hays), and Jewell (14 miles north of Mankato) counties.

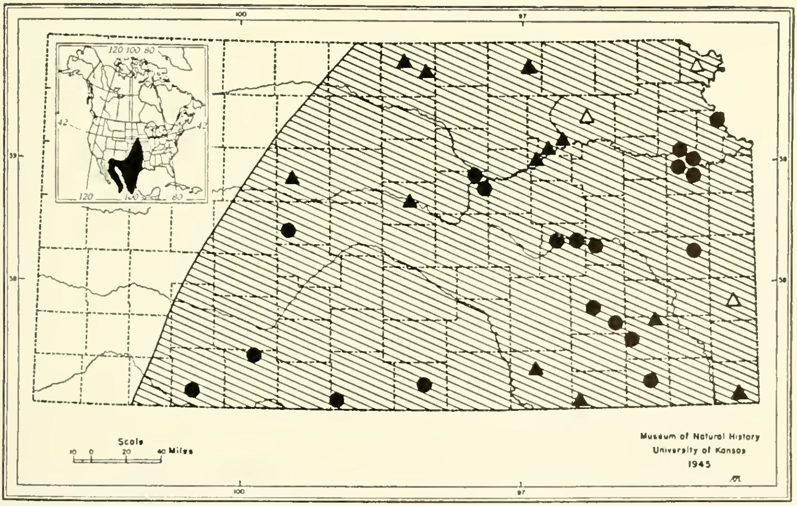


FIG. 76. Distribution of the western narrow-mouthed frog, *Gastrophryne olivacea*, in Kansas, with insert showing range of the species.

Description.—Skin smooth; no parotoid glands; no tympanum visible; head narrow, pointed, considerably narrower than body; no webs on either fingers or toes; a cornified inner but no outer metatarsal tubercle; a transverse groove passing across head between posterior borders of orbits and extending onto each side of head behind angles of jaws, and sometimes completely encircling the head; no tarsal fold; a groove across chest between armpits.

Color slate or brownish gray above, either uniform or with a few black spots scattered over back and hind legs; ventral surface whitish, immaculate or with faint reticulations of dark color on throat and sides. In males the throat is black.

Size small, maximum snout-vent measurement being 1⅞₁₆ inches.

Recognition Characters.—This species differs from all other Kansan anurans, save only *Gastrophryne carolinensis,* in the absolute absence of webs between the toes; it is also the only one in which the tympanum is entirely concealed. The broad body and narrow, pointed head are also distinctive. The most obvious distinction from *G. carolinensis* is in belly markings; in *G. olivacea* the belly is completely unpigmented, while in *G. carolinensis* the belly is heavily pigmented except in pigmentless areolae.

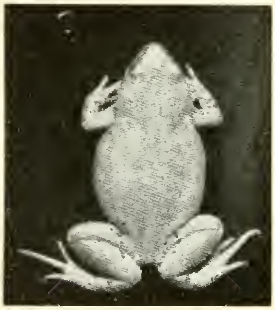


FIG. 77. A western narrow-mouthed frog, *Gastrophryne o. olivacea*, × 1, from 5 miles north and 1 mile east of Lawrence, Douglas County, Kansas. Photo by W. W. Tanner and T. P. Lyle.

Habits and Habitat.—This frog is found in wooded areas, sometimes in rocky zones. Rocks are the usual cover in Kansas, but the animal is subterranean in habits and in many parts of its range outside Kansas it inhabits rockless areas.

Breeding occurs from April through early September, after rainstorms when the temperature is high. While active early in spring, at least in April, breeding is delayed until later in the season. The call is a slight peep followed by a high-pitched shrill buzz of two to three seconds duration, audible at a distance of 50 to 100 feet.

The eggs, some 600 in number, are laid as a surface film. Tadpoles transform thirty to fifty days after hatching.

Kansan Subspecies.—Two subspecies are recognized. The one in Kansas is *G. o. olivacea.* The other, *G. o. mazatlanensis* Taylor, occurs in Arizona and northwestern Mexico.

References.—Smith, 1934: 501-505, map 24, fig. 30 (description, natural history); Bragg and Smith, 1942: 40 (breeding); Bragg, 1943: 75-76 (breeding); Wright and Wright, 1949: 578-583, pl. 126 (description, natural history); Hecht and Matalas, 1946: 1-26 (taxonomic review); Freiburg, 1951 (thorough ecological study); Tanner, 1950: 47-48 (habits); Carvalho, 1954: 12-13 (generic status).

CLASS REPTILIA Laurenti

Two orders of reptiles occur in Kansas: the Testudines or turtles, and Squamata. The latter includes the two suborders of lizards (Sauria) and snakes (Serpentes).

One other order, the Crocodilia, possibly occurred naturally in Kansas at one time, but is now extinct in the state and in fact is not now reliably known nearer than eastern Texas. The only representative concerned, the alligator, was reported by Cragin in 1885 from the Arkansas River at Wichita, and this report has received credence rather widely. This is the only indication, so far as known, of the occurrence of the species naturally within the borders of the state. The range of the species has rapidly diminished in historic times, however, and it is entirely reasonable to suppose that the alligator formerly ranged up the Arkansas River as far as Wichita. Explorers reported in the early days of settlement in Texas that the species occurred commonly far in the northwestern part of the state, while it is now restricted to the southeastern corner.

Even at the present time reports are circulated at intervals of the discovery of alligators in ponds and streams in various parts of Kansas. All specimens reported are small, however, and the conclusion is inescapable that they have been imported and subsequently released or permitted to escape. The alligator, therefore, is not included as a member of the present fauna of Kansas.

Deletion of the alligator from the faunal list for Kansas is compensated for numerically by the addition of one other reptile apparently not formerly occurring in the state—the so-called American chameleon, better termed the Carolina anole. This small lizard, so popular in the "pet" trade of this country, has reportedly become established in the environs of Leavenworth, Kansas, as a result of the release of imported animals. Although introduced, it may rightfully be counted as a member of the present Kansas fauna if the lizard actually becomes successfully established, as it is claimed it is. Thus slowly does the fauna of a region change. The permanence of the addition of the Carolina anole to the Kansas fauna is not assured, however; only continued attention to the colonies known will reveal the ultimate success of the introduction. Reports from persons familiar with the Kansan colonies, or with other introduced species, would be of great value. Wanton introduction of species of any animal into new areas is highly undesirable, but where it has occurred a study of the history of the colonies can be of some scientific value.

Reptiles do not pass through a transformation from a larval to a juvenal stage as do amphibians. Accordingly the keys given here should apply equally well to all post-embryonic stages.

The eggs of reptiles are incompletely known and no serious attempt has ever been made to distinguish those of one kind from those of another. Within certain limits such differentiation should be possible, and deserves the attention of students of natural history.

Not all reptiles lay eggs. All turtles do lay eggs as also do all species of lizards in the state of Kansas unless the short-horned lizard, a live-bearer, actually does occur in the state. A number of snakes produce active young. They include all members of the subfamily Natricinae (*Thamnophis, Natrix, Storeria, Haldea,* and *Tropidoclonion*), and all of the pit vipers (family Crotalidae) of this state. In some species little exchange of materials occurs between embryo and mother, but in others the exchange is so extensive as to require a placenta of sorts. In the more primitive live-bearing snakes the eggs are thus simply held in the body until, in effect, they hatch. Occasionally an individual of such a species may actually lay eggs that hatch very shortly after deposition (suspected of *Haldea*). Some egg-laying species approach the live-bearers, laying eggs that hatch in but a few days (as in *Opheodrys vernalis*) or, in rare instances, actually giving birth to the active young (*Diadophis punctatus*).

There are almost as many definitions of turtle, slider, terrapin and tortoise as there are herpetologists. The definitions preferred by perhaps most are as follows. Terrapins are members of the genus *Malaclemys,* restricted to salt-water marshes of the Atlantic coast of the United States and perhaps Mexico; they are highly prized for food. Tortoises are members of the family Testudinidae, of world-wide distribution in areas of tropical and subtropical climate, occurring in the United States only in the extreme south from Florida to Arizona (genus *Gopherus* only). Sliders are members of the genus *Pseudemys,* all river turtles, restricted to North America north of Panamá. Turtles are any and all members of the order Testudines.

KEY TO ORDERS AND SUBORDERS OF REPTILIA

1. Limbs and head retractable within a leathery or bony shell; turtles. Order Testudines, p. 119

1′. Limbs and head not retractable; no shell .... Order Squamata, p. 163

   2. Belly with a single row of large, undivided, transverse plates; always limbless; most snakes .... Suborder Serpentes, p. 210

2′. Belly with many rows of scales, sometimes arranged in a transverse series, but never fused together into single transverse plates; legs present except in two species.
  3. No eyelids; a scale, several times as large as eye, covering latter; worm snakes . . . . Suborder Serpentes, p. 210
  3′. Eyelids present; eye not covered by a scale larger than eye; lizards . . . . Suborder Sauria, p. 163

Turtles

ORDER TESTUDINES Batsch

Thirteen species of turtles, belonging to four separate families, occur in the state, and no species is represented by more than one subspecies. Two other species, *Emys blandingii* and *Kinosternon subrubrum,* probably will be found to occur in the state. The part of the shell shielding the upperpart of a turtle is the carapace; and the part shielding the lower part of the animal is the plastron. The two parts of the shell are united by a narrow bridge on each side of the body. In all except the soft-shelled turtles, the shell is covered by a number of large, thin, horny plates or laminae. They are illustrated and named in Figures 81 and 82B.

KEY TO SPECIES OF TURTLES

1. Shell soft and leathery at least at edges, not covered by large plates.
  2. Anterior border of carapace absolutely smooth; wall separating nostrils from each other smooth and even, without longitudinal ridges (Fig. 78A) . . . . *Amyda mutica,* p. 157

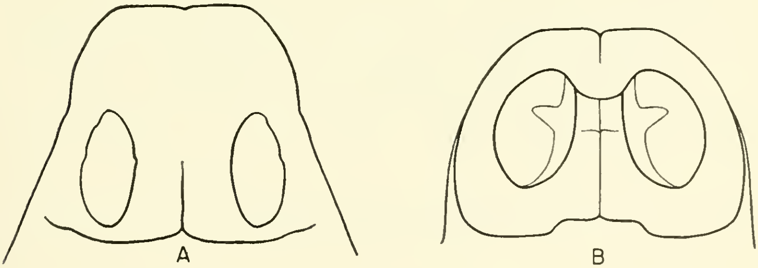


FIG. 78. Anterior view of tips of snouts of soft-shelled turtles. A. Smooth soft-shelled turtle, *Amyda mutica,* × 15, K. U. no. 1962, De Valls Bluff, Prairie County, Arkansas. B. Desert soft-shelled turtle, *Amyda ferox emoryi,* × 9, K. U. no. 3128, Phoenix, Maricopa County, Arizona. Both drawings by Ann Murray.

  2′. Anterior border of carapace provided with tubercles; wall separating nostrils from each other provided with a prominent ridge on each side which projects into each nasal opening (Fig. 78B). *Amyda ferox,* p. 160

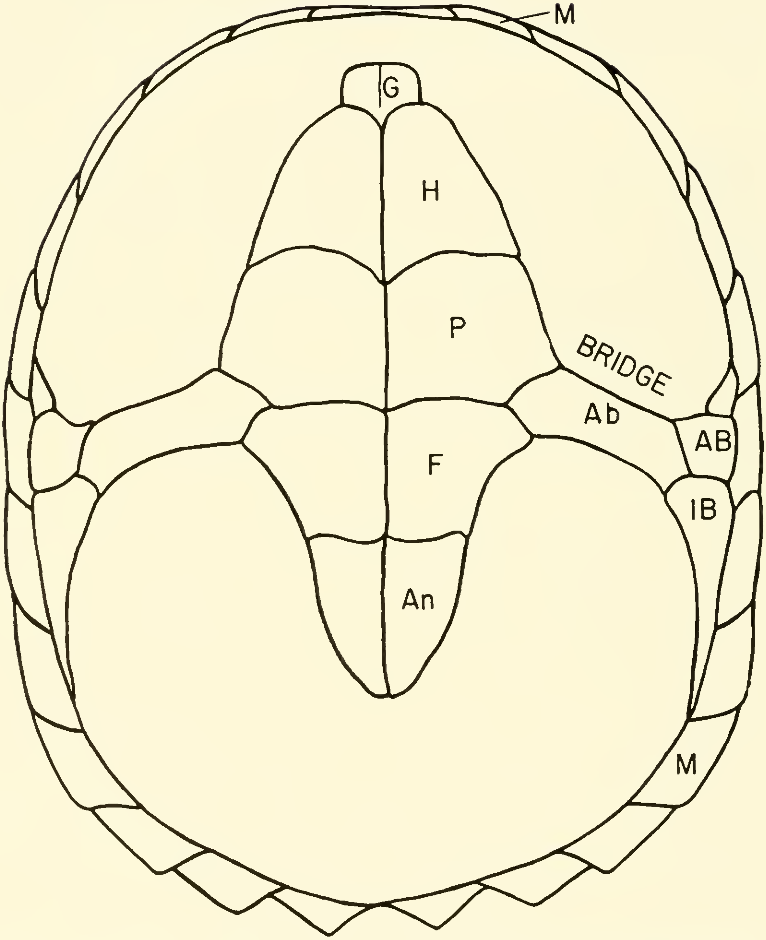


FIG. 79. Laminae of plastron of common snapping turtle, *Chelydra serpentina*, × ⅔, K. U. no. 3388, De Valls Bluff, Prairie County, Arkansas; AB, axillary bridge scale; Ab, abdominal; An, anal; F, femoral; G, gular (usually not even partly split, as here); H, humeral; IB, inguinal bridge scale; P, pectoral.

1′. Shell hard, bony, covered by large laminae.

2. Zone where upper and lower shells are fused (the "bridge") at least twice as broad as long (Fig. 79).

3. Head covered with smooth, symmetrical plates; scales on under side of tail irregularly arranged; tubercles on sides of neck branched; 3 to 5 extra scutes between marginals and costals above the bridge (Fig. 80, x) . . . *Macroclemys temminckii,* p. 131

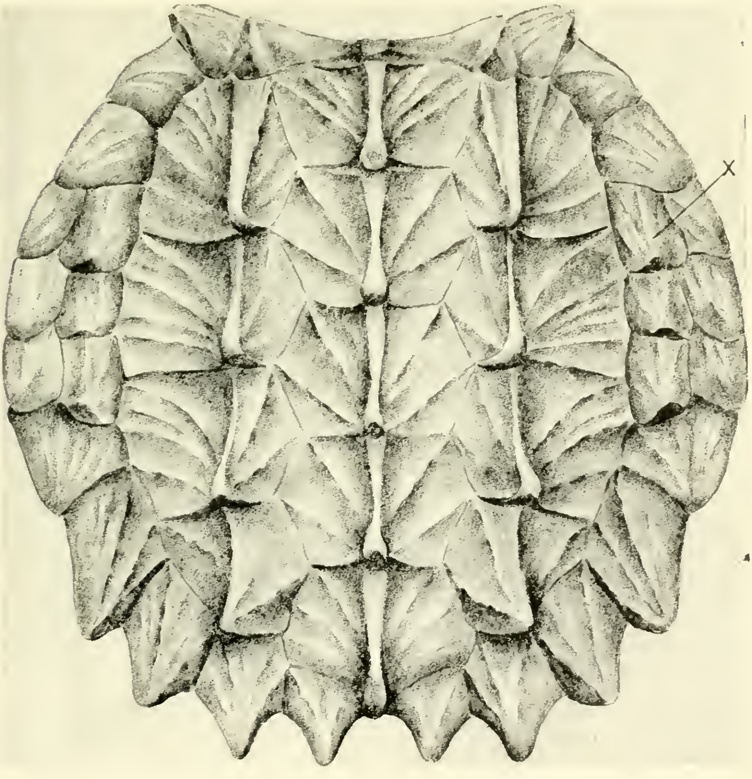


FIG. 80. Carapace of alligator snapping turtle, *Macroclemys temminckii,* × ½, K. U. no. 3401, De Valls Bluff, Prairie County, Arkansas; the lateral marginals, actually not visible in dorsal view, are depicted as though they were, in order clearly to indicate the supramarginals (indicated by X).

3′. Head covered with soft skin; scales on under side of tail arranged in 2 rows at least in part; tubercles on sides of neck unbranched; no extra scutes between marginals and costals. *Chelydra serpentina,* p. 134

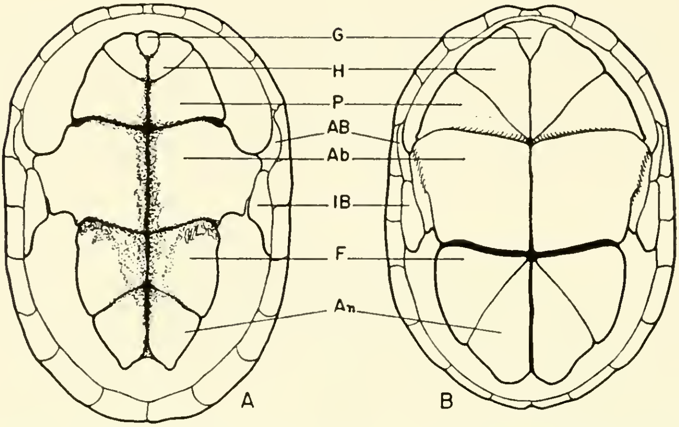


FIG. 81. Plastra of musk and mud turtles. A. Common musk turtle, *Sternotherus odoratus*, × ½, K. U. no. 17122, 1 mile east of Climax, Greenwood County, Kansas. B. Yellow mud turtle, *Kinosternon flavescens*, × ½, K. U. no. 20521, 1 mile northwest of Aetna, Barber County, Kansas. Labels as in Fig. 75A. The stippling indicates the area of uncornified skin; the other areas are cornified.

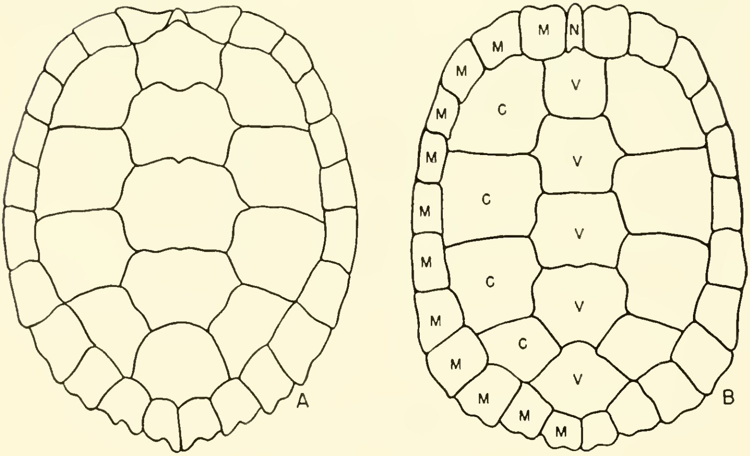


FIG. 82. Laminae of carapaces of false map turtle and elegant slider. A. False map turtle, *Graptemys pseudogeographica*, × ⅓, K. U. no. 3238, De Valls Bluff, Prairie County, Arkansas. B. Elegant slider, *Pseudemys scripta*, × ⅓, K. U. no. 3328, Pratt, Pratt County, Kansas. C, costals; M, marginals; N, nuchal; V, vertebrals.

2′. Bridge about as long as wide or longer (Fig. 81).
  3. Plastron (exclusive of bridge) with 5 pairs of scutes preceded usually either by no other scutes or by an unpaired one (if by another pair, then these extremely minute); plastron completely separated from carapace by uncornified skin and by two or more small bridge laminae.
    4. First pair of scutes on lower side reaching (or nearly reaching) 3rd pair at midline (Fig. 81B). *Kinosternon flavescens,* p. 129
    4′. First pair of scutes widely separated from 3rd pair (Fig. 81A) . . . . *Sternotherus odoratus,* p. 126
  3′. Plastron (exclusive of bridge) with 6 pairs of scutes, the anterior of which is not minute; plates of plastron at least partially in direct contact with plates of carapace at bridge.
    4. Front part of plastron hinged onto the rest and movable.*
      5. Upper jaw notched at apex; carapace black with hundreds of small, round or oval, yellow spots (not yet recorded from Kansas) . . . . *Emys blandingii,* p. 323
      5′. Upper jaw hooked at apex; carapace brownish, with no markings or with radiating light streaks.
        6. Usually 3 claws on rear feet; markings absent below, dim above; median scales on carapace keeled. *Terrapene carolina,* p. 137
        6′. Usually 4 claws on rear feet; distinct, radiating yellow lines above and below; no keel on carapace. *Terrapene ornata,* p. 141
    4′. Entire plastron solid (no part hinged) and immovable.
      5. Carapace smoothly rounded behind, edges of all plates even; a notch at tip of upper jaw, flanked on either side by a short projection (Fig. 83A) . . . *Chrysemys picta,* p. 149

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* Of preserved specimens which are hardened, those with the hinges have a very deep groove between the pectoral and abdominal laminae.

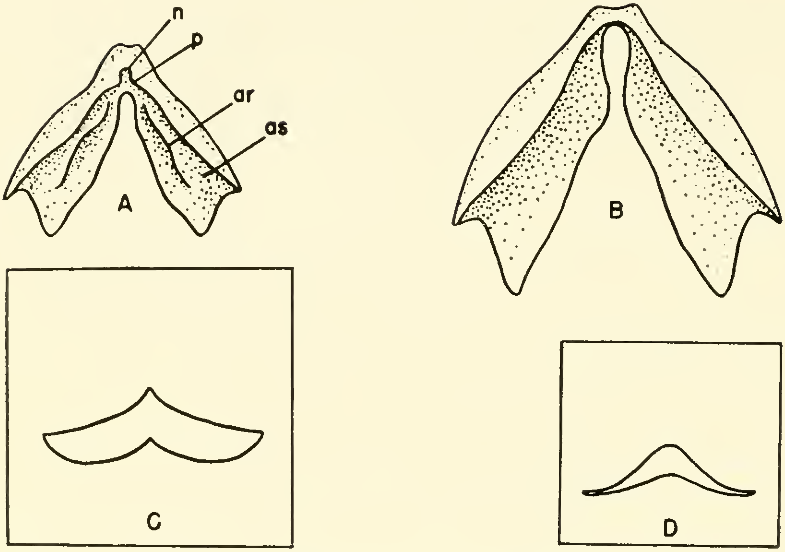

FIG. 83. A. Palatal view of upper jaw of a skull of a painted turtle, *Chrysemys picta*, × 2, K. U. no. 1914, Pratt, Pratt County, Kansas. B. Palatal view of upper jaw of skull of a false map turtle, *Graptemys geographica*, × 2, K. U. no. 2466, Doniphan Lake, Doniphan County, Kansas. C. Edges of lips as seen with the mouth partly open, front view, of an elegant slider, *Pseudemys scripta*, × ⅔, K. U. no. 17227, ½ mile west of Runnymede, Kingman County, Kansas. D. Edges of lips as seen with the mouth partly open, front view, of a map turtle, *Graptemys geographica*, × ⅔, K. U. no. 3265, Franklin County, Kansas. ar, alveolar ridge; as, alveolar surface; n, notch; p, protuberance.

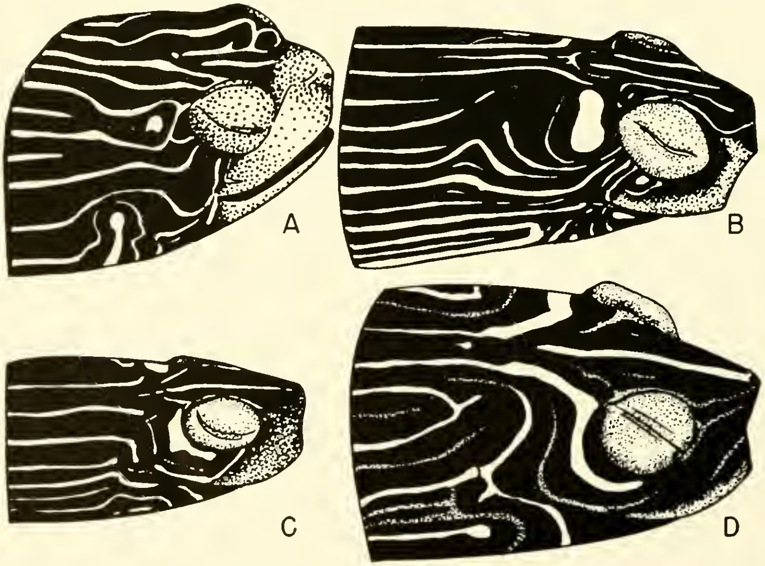

FIG. 84. Patterns, on heads of map turtles, all from dorsolateral view, × 2. A. Map turtle, *Graptemys geographica*, K. U. no. 3265, Franklin County, Kansas. B. False map turtle, *Graptemys pseudogeographica*, K. U. no. 3288, Neosho River, Coffey County, Kansas. C. Same, K. U. no. 3298, Verdigris River, Montgomery County, Kansas. D. Same, K. U. no. 3287, Neosho River, Coffey County, Kansas.

5′. Carapace notched and irregular behind (Fig. 82); no notch on upper jaw, or if so it is not flanked on either side by a projection (Figs. 83B, C, D, 85A, C).

6. Crushing surface of upper jaw (as seen with mouth open) not ridged (Fig. 83B); plate in middle of anterior margin ("nuchal") less than twice as long as broad (Fig. 82A).

7. A small (much narrower than diameter of orbit), more or less triangular, yellow spot behind eye; a distinct, vertical light line between this spot and eye (Fig. 84A). *Graptemys geographica,* p. 144

7′. A large (at least as wide as diameter of orbit) crescentic or transverse yellow spot (frequently linelike) behind eye, often continued forward under eye and backward on neck; no or only dim light lines between this spot and eye (Fig. 84B, C, D). *Graptemys pseudogeographica,* p. 147

6′. Crushing surface of upper jaw (as seen with mouth open) with a ridge running parallel to the edge of the jaw (Fig. 85A, C); nuchal at least twice as long as broad (Fig. 82B).

7. The broad light stripe which originates at posterior corner of eye † of uniform diameter, not widened posteriorly (Fig. 86C); ridge on crushing surface of upper jaw serrate. (Fig. 85A); lower jaw serrate at sides (Fig. 85B) . . *Pseudemys floridana,* p. 152

7′. The broad light stripe which originates at posterior corner of eye greatly widened posteriorly (Fig. 86A, B); ridge on crushing surface of upper jaw smooth (Fig. 85C); lower jaw not toothed at sides . . . . *Pseudemys scripta,* p. 155

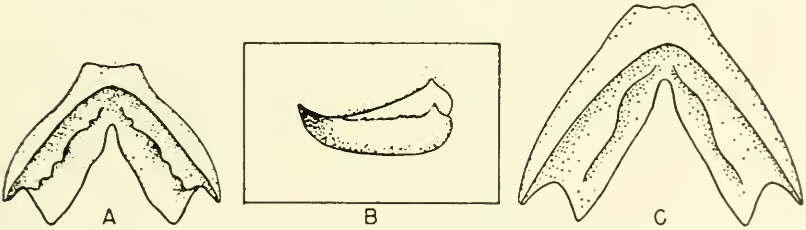

FIG. 85. A. Palatal view of upper jaw of a skull of a saw-toothed slider, *Pseudemys floridana,* × 1½, K. U. no. 1179, De Valls Bluff, Prairie County, Arkansas. B. Dorsolateral view of lower jaw of same, × 1½. C. Palatal view of upper jaw of a skull of an elegant slider, *Pseudemys scripta,* × 1½, K. U. no. 2899, Doniphan Lake, Doniphan County, Kansas.

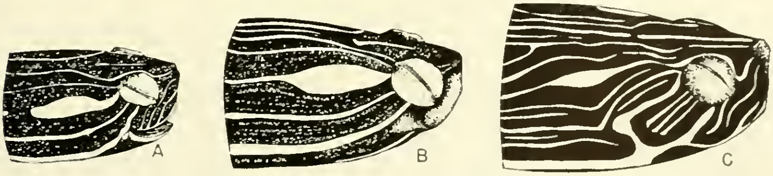

FIG. 86. Patterns on heads of sliders, all from dorsolateral view, × ¾. A. Elegant slider, *Pseudemys scripta,* K. U. no. 17227, ½ mile west of Runnymede, Kingman County, Kansas. B. Same, K. U. no. 3328, Pratt, Pratt County, Kansas. C. Saw-toothed slider, *Pseudemys floridana,* K. U. no. 3385, De Valls Bluff, Prairie County, Arkansas.

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† Care should be taken not to confuse this light stripe with one which closely skirts the orbit but which actually originates along its median border.

FAMILY KINOSTERNIDAE

Genus *Sternotherus* Gray

Common Musk Turtle

Sternotherus odoratus (Latreille)

Testudo odorata Latreille, Hist. Nat. Rept., vol. 1, 1801, p. 122 (type locality—Charleston, South Carolina).
Sternotherus odoratus Bell, Zoöl. Journ., vol. 2, 1825, p. 307.

Range.—Southeastern part of state. Recorded as far west as Pratt, Pratt County; Wichita, Sedgwick County; and 11 miles southeast of Winfield, Cowley County; and as far north as 2 miles north of Lawrence, Douglas County, and Lake of the Forest, Wyandotte County (not mapped). The record for "Wallace Co." (KU) needs verification because it is doubtful, although the species may occur much farther west along major streams than is now known.

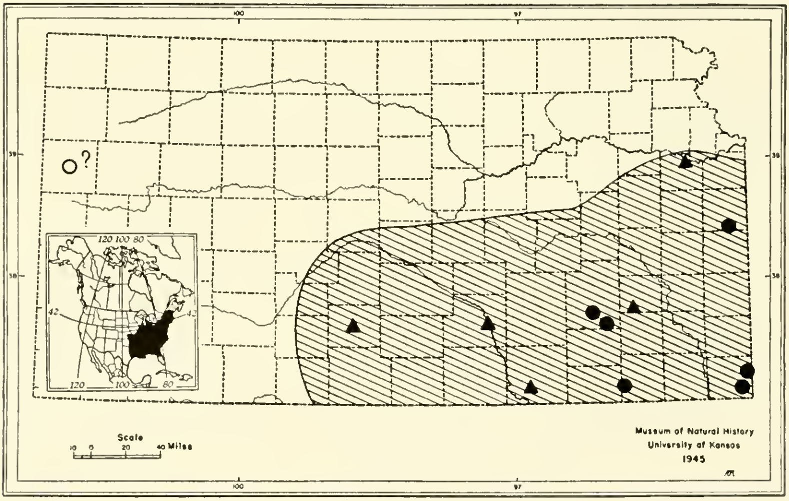


FIG. 87. Distribution of the common musk turtle, *Sternotherus odoratus*, in Kansas, with insert showing range of the species.

Description.—Carapace, except in young, with only feeble keel along the middle line, or none at all; young specimens may have three keels. Two hinges in plastron, allowing free movement of its front part, and restricted movement of rear part (except in young, in which entire plastron may be rigid). Laminae on plastron completely separated from small marginal laminae on carapace by two small shields; five pairs of laminae on plastron, and one small unpaired lamina (gular) at extreme anterior tip; lamina on either side of gular widely separated from hinge, reaching only about halfway there from anterior margin of plastron. Adult males with two curious patches of horny scales on inner margin of each hind leg.

Skin rather spiny; two conspicuous chin barbels; all digits clawed.

Dark olive or brown above, sometimes with darker streaks. Color below the same, except that margins of plates may be white. Two narrow yellow streaks, dim in adults and very prominent in the young, along either side of head.

Size small, carapace of largest recorded specimen measuring 5⅓ inches in straight line from front to rear margin.

Recognition Characters.—The combination of having eleven laminae on the plastron, the 1st pair of which is separated from the front hinge by half the length of the front lobe of the plastron, is distinctive; no other turtle in Kansas has both these characters. The yellow mud turtle, *Kinosternon flavescens,* which has the same general appearance, has the first *pair* of ventral laminae in contact with the front hinge or narrowly separated from it.

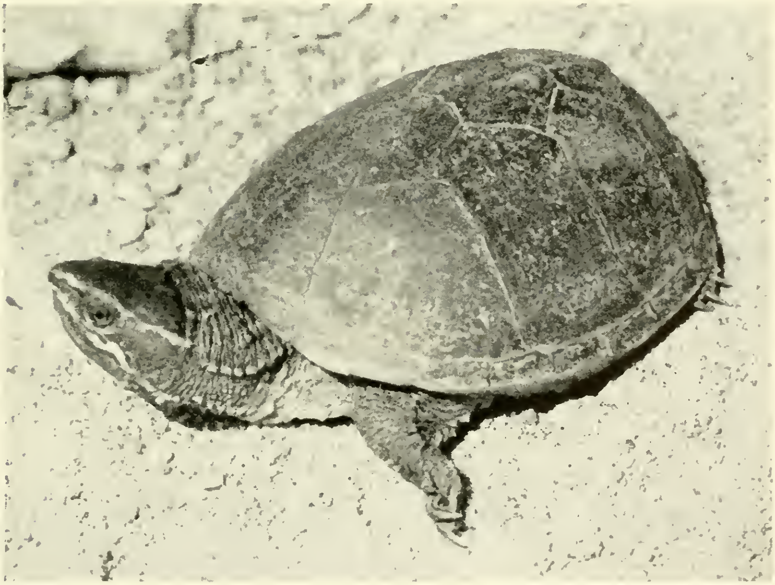


FIG. 88. A common musk turtle, *Sternotherus odoratus,* × ⅘. Courtesy of the Zoölogical Society of Philadelphia.

Habits and Habitat.—Sluggish or still, deep waters, with mud-bottoms, along river banks, in ponds, lakes and marshes, are typically inhabited by this species. These turtles are mostly bottom dwellers and are not good swimmers. The food is usually found and eaten under water. Normally it consists of earthworms, aquatic insects, small snails, crayfish, minnows and tadpoles. Sometimes plant food is taken. The animals seldom bask in the sun.

Mating occurs in the fall and spring, and egg-laying in early or middle summer. Two to seven (usually 3 to 5) eggs are laid and covered in a shallow excavation dug by the female under or near a log, stump or similar protection, not farther than 200 feet from water. The eggs are thick, have brittle shells, and average 1 1/16 × 5/8 inches in size. Under artificial conditions the eggs hatch in two to three months.

Males reach sexual maturity in three or four years and females in nine to eleven years. For each sex, about ten years are required to attain a length 3 1/7 inches. In captivity they have lived as long as twenty-three years.

These turtles hibernate in mud at various depths down to a foot below its surface where the mud is covered with water. They emerge in March. When captured they are rather vicious, biting upon but slight provocation. The bite is not severe, however, and does not break the tougher skin of the hand of a person. After a time in captivity they become tame and will eat from the fingers. They have voracious appetites, and survive exceedingly well under the unnatural conditions of captivity.

These turtles have a strong, offensive odor, which probably serves as a protection from natural enemies. The odor is produced by the secretions of four glands, one on each side near the rear margin of the bridge at the border of the carapace, and one at the margin of the carapace halfway between the bridge and the middle line anteriorly.

This species seems to have no economic value whatever, so far as man is concerned; it is neither detrimental nor beneficial.

A peculiarity of males only is an odd clasping organ on the rear surface of the hind legs. It consists of an oval patch of enlarged, heavy, rough scales on the thigh, and another on the shank. The two surfaces are thought to be used in copulation to grasp the edges of the carapace of the female, although the function is not actually known. Other unique features of the males are a long, stout tail terminating with a relatively large, blunt, clawlike scale (the tail is short and clawless in females); a smooth tail (a mid-dorsal row of tubercles in females); and smaller scutes (and accordingly larger non-cornified areas) on the plastron than in females.

Kansan Subspecies.—No subspecies of this species are recognized, either in Kansas or elsewhere.

References.—Carr, 1952: 82-89, pl. 12, map 4 (general account); Pope, 1939: 37-47, pls. 5, 6, 7 (description, life history, habits, range).

Genus *Kinosternon* Spix

Yellow Mud Turtle

Kinosternon flavescens (Agassiz)

Platythyra flavescens Agassiz, Contr. Nat. Hist. U. S., vol. 1, 1857, p. 430; vol. 2, 1857, pl. 5, figs. 12-15 (type locality—Waco, Texas).

Cinosternum flavescens Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 52.

Range.—State-wide except perhaps the northeastern corner of the state. Recorded as far east as Cherokee (Columbus), Franklin, and Republic (Republic) counties. Uncommon east of the Arkansas River.

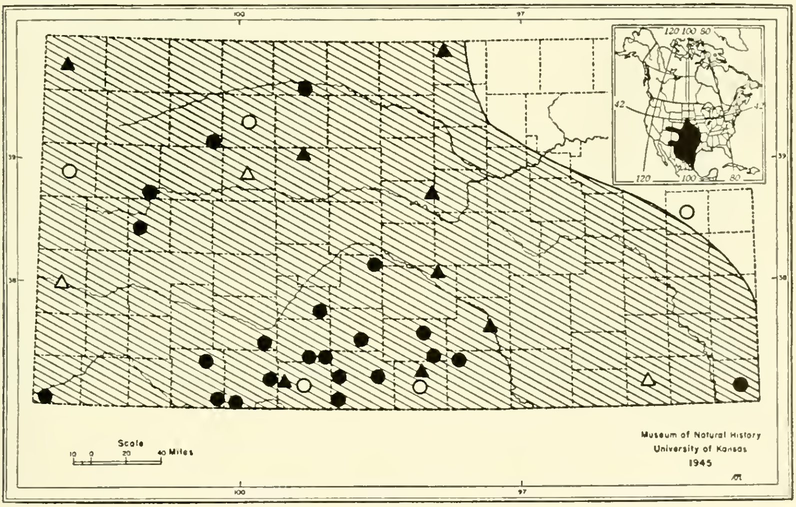


FIG. 89. Distribution of the yellow mud turtle, *Kinosternon flavescens*, in Kansas, with insert showing range of the species.

Description.—Carapace without a keel, except in the young, which may have a feeble keel along the midline. Two hinges in plastron, allowing free movement of the front part and restricted movement of rear part. Laminae on plastron separated completely from small marginal plates of carapace by two small shields; five pairs of laminae on plastron, and one small, unpaired lamina (gular) at extreme anterior tip; lamina on either side of gular nearly or quite reaching hinge. Adult males with two curious patches of horny scales on inner margin of each leg. A pair of barbels on chin.

Dull olive-brown above, and yellowish brown below. Head and other exposed parts of body olive above, with few if any markings; head and neck much lighter, yellowish below.

Size small, carapace of largest recorded specimen measuring 5¾ inches in straight line from front to rear margin.

Recognition Characters.—Having 11 laminae on the plastron, the first *pair* of which is in contact with, or narrowly separated from, the front hinge is a distinctive combination. No other turtle in Kansas has both these characters. Most easily confused with it is the common musk turtle, *Sternotherus odoratus,* which has much the same appearance, but in the latter species the first *pair* of ventral laminae is separated from the front hinge by half the length of the front lobe of the lower shell.

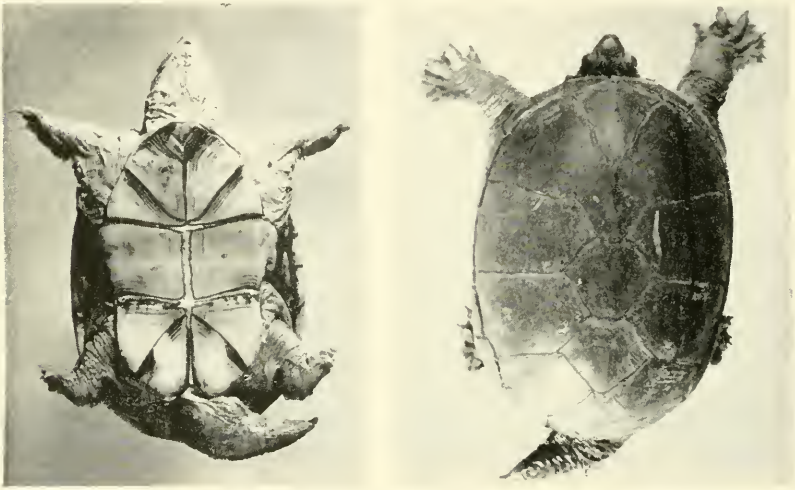


FIG. 90. Dorsal and ventral views of a yellow mud turtle, *Kinosternon f. flavescens,* × approximately ½, 6½ miles west and ¼ mile south of Scott City, Scott County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Habits and Habitat.—Any mud-bottomed waters, shallow or deep, make suitable habitats for this species. It is mainly a bottom dweller, and a rather poor swimmer. The food accepted in captivity includes tadpoles, earthworms, salamanders, snails, raw meat and fish. Plant food, insects, snails, and small vertebrates may comprise part of the natural diet. This species is said to bask often in the sun.

Probably the patches of scales on the hind legs of males serve as grasping devices and not as sound-producing structures.

The two eggs usually laid measure approximately 1 × ⅜ inch.

Having a strong odor, this species is known as the "stink pot."

Kansan Subspecies.—*Kinosternon flavescens flavescens* is the only subspecies occurring in Kansas. Two other subspecies, *K. f. stejnegeri* Hartweg and *K. f. spooneri* Smith, occur in Mexico and Illinois, respectively.

References.—Carr, 1952: 94-99, pl. 15, map 5 (general account); Pope, 1939:52-55 (description, life history, habits, range).

FAMILY CHELYDRIDAE

Genus *Macroclemys* Gray

Alligator Snapping Turtle

Macroclemys temminckii (Troost)

Chelonura temminckii Troost, in Harlan's Med. Phys. Res., 1835, p. 158, footnote (type locality—tributary stream of the Mississippi above Memphis, in western Tennessee).

Macroclemys temminckii Gray, Cat. Shield Rept., I, 1855, p. 49.

Range.—Tributaries of the Arkansas River as far north and west as Florence, Marion County (on Neosho-Cottonwood rivers), Augusta, Butler County (on Walnut River), Wichita, Sedgwick County (on Arkansas River), and Baxter Springs, Cherokee County (on Spring River).

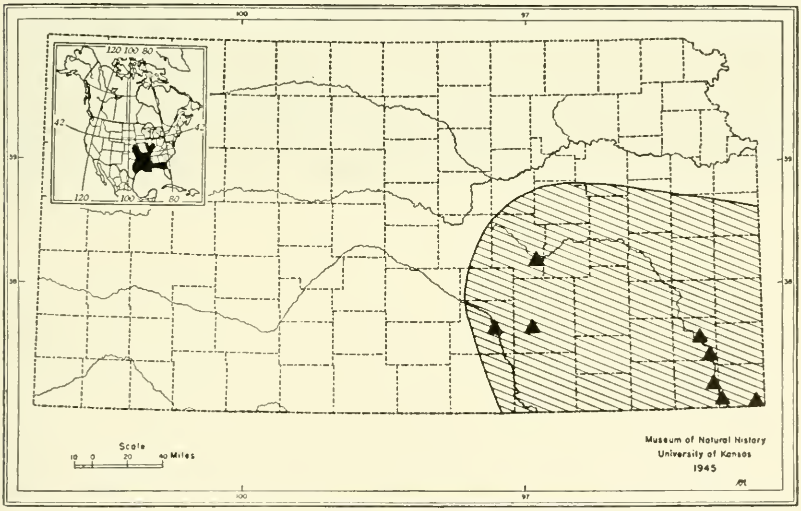


FIG. 91. Distribution of the alligator snapping turtle, *Macroclemys temminckii*, in Kansas, with insert showing range of the species.

Description.—Carapace, in both young and adults, with three prominent, high keels. Plastron small, cross-shaped, and lacking hinges. Nine laminae on plastron; anterior single lamina sometimes partly split into two. Bridge narrow, separated from marginal laminae of carapace by rows of two large and usually two small plates. Marginal laminae of carapace not visible at sides in dorsal view, concealed by the presence of three or four extra plates (supramarginals) between them and costal plates. Pronounced beak on both jaws; large plates covering head. Lower surface of tail with numerous, irregularly arranged, small scales; row of plates no higher than wide, on midline of tail.

Dull brownish above, on shell, limbs, tail and head; lower surface whitish.

Size, largest of any American, nonmarine turtle; weight up to 200 pounds (there is a highly questionable record for 403 pounds). Measurements not available for large specimens; one with carapace 24.02 in. (in a straight line) long weighed 103 pounds.

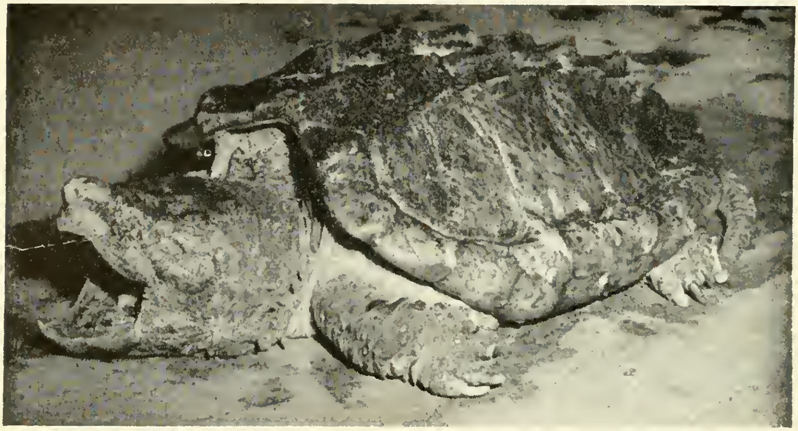


FIG. 92. An alligator snapping turtle, *Macroclemus temminckii*, × ⅛. Courtesy of the Zoölogical Society of Philadelphia.

Recognition Characters.—No other turtle in Kansas has the combination of fewer than eleven laminae on the plastron (excluding the bridge) and plates on top of the head. The only other species resembling it is the common snapping turtle (*Chelydra*) which is most easily distinguished—once the difference is seen—by the absence from the carapace of the highly elevated keels characteristic of the alligator snapper.

In the young alligator snapper the three keels on the carapace are high instead of merely prominent as in *Chelydra* which, as it grows older, loses the keels. In the alligator snapper the keels remain highly elevated throughout life. In addition it has numerous small scales on the lower side of tail instead of two rows of large plates; and a row of plates which are no higher than wide on the midline of the top of the tail (in *Chelydra,* height greater than width). *Macro-*

clemys has hard plates on the head instead of soft skin as in *Chelydra,* and possesses supramarginal plates (absent in *Chelydra*).

Habits and Habitat.—This turtle is a bottom-dweller, swimming but little, and living in large, muddy-bottomed rivers and canals.

The food presumably consists of fish. An extraordinary structure, apparently serving as a lure for prey, is a narrow blood-red band of tissue, on the middle of the tongue, which can be set in serpentine motion. This structure closely resembles a wriggling worm. The mouth otherwise is dull-colored, much like the rest of the entire animal. It is thought that the turtle rests on the bottom of the river with the huge jaws wide open, revealing to view in the murky waters only the squirming lure; unsuspecting fish in search of a meal thus themselves become food.

For protection, this species relies chiefly upon camouflage. Dull-colored, mud-coated and with a growth of algae, these turtles easily conceal themselves, and remain motionless with wide-open jaws even when disturbed. Once enraged, however, they are exceedingly ferocious. Although the jaws are large and the beak formidable, the fabulous tales of these turtles biting through inch boards and broom handles are erroneous. It is nevertheless obvious that extreme caution in the proximity of an angered specimen is highly expedient.

These turtles are known to live at least seventy-five years, and in all probability they exceed this age twofold. The specimen still alive in the Philadelphia Zoo, kept for fifty-five years (since May 6, 1890), weighed only fifty-two pounds in 1939.

Authentic records of the maximum size and weight of this species are much to be desired. The largest accurately recorded weight is 219 pounds; all reports giving figures in excess of this are based upon visual estimates of various observers. Large specimens occasionally are in even relatively small creeks and rivers, perhaps in part because these creatures regularly migrate upstream at a recorded rate of about six miles a year, at least in Oklahoma. An interesting possible correlation is the fact that fishes in a single area soon learn not to bite at the tongue lure. Therefore the turtle must constantly need to invade new areas to secure food.

Kansan Subspecies.—No subspecies of this species have been distinguished.

References.—Carr, 1952: 52-60, pls. 6-7, map 1 (general account); Pope, 1939: 66-71, pls. 16, 17 (description, life history, habits, range).

Genus *Chelydra* Schweigger

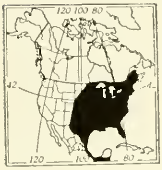
Common Snapping Turtle

Chelydra serpentina (Linnaeus)

Testudo serpentina Linnaeus, Syst. Nat., ed. 10, vol. 1, 1758, p. 199 (type locality—New Orleans, Louisiana).

Chelydra serpentina Schweigger, Königsberg. Arch. Naturw. Math., vol. 1, pt. 3, 1812, p. 293.

Range.—State-wide. Taken as far west as Rawlins (Ludell), Sherman (North Fork of Smoky Hill River at county line) and Morton (12 miles north of Elkader) counties, and east to Marshall (Blue Rapids), Doniphan (Doniphan Lake), Leavenworth (Fort Leavenworth), Miami (Pigeon Lake) and Cherokee (Columbus) counties.



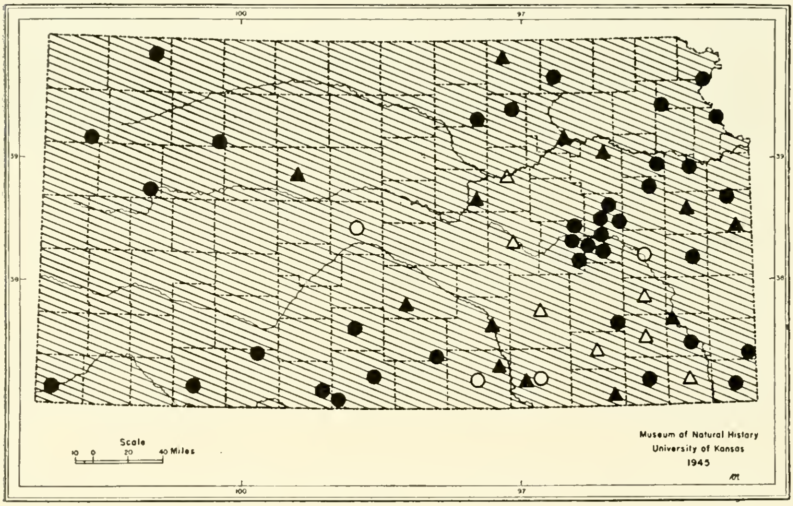


FIG. 93. Distribution of the common snapping turtle, *Chelydra serpentina,* in Kansas.

Description.—Carapace with three fairly prominent lengthwise ridges (keels) in the young, becoming low or invisible in adults. Plastron small, cross-shaped, and lacking hinges. Nine laminae on plastron; anterior single lamina sometimes partly or wholly split into two. Bridge narrow, separated from marginal laminae of carapace by row of two large and usually two small laminae. Pronounced beaks on both jaws. Lower surface of tail with relatively large laminae mostly arranged in two rows; row of large bony triangular, projecting plates much higher than wide on midline of upper surface of tail.

Dull brown above, light below, often obscured by algal growth.

Weight frequently as much as fifty pounds; one fattened in a swill-barrel weighed eighty-six pounds.

Recognition Characters.—The presence of fewer than eleven laminae on the plastron (exclusive of the bridge) in combination with the presence of soft skin (instead of hard plates) on the head, distinguishes this species from all others in Kansas. Both this species and the alligator snapper have very small lower shells (plastrons), and resemble each other also in other respects. See discussion of *Macroclemys* for comparison.

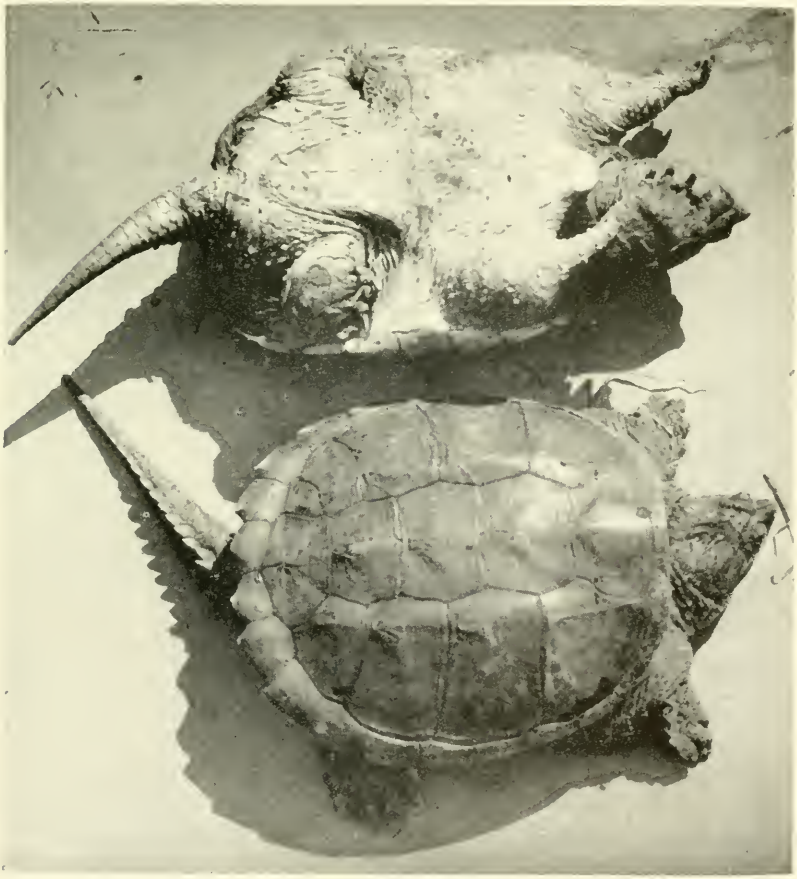


FIG. 94. Common snapping turtles, *Chelydra s. serpentina*, × 1/5. Courtesy of the Zoölogical Society of Philadelphia.

Habits and Habitat.—Practically any permanent waters are inhabited by this species. Preferred habitats are mud-bottomed ponds and streams. It is a bottom-dweller and a poor swimmer.

Wholesale slaughter of snappers is seldom if ever recommended as a desirable method of protecting other animals. Generalizations are difficult to make, however, since every body of water has its own unique combination of variables. Nevertheless, autopsies of large numbers of snappers indicate that, strange as it may seem, between 35 percent and 70 percent of the food consists of vegetation, and only 6 percent to 35 percent of game and pan fishes, many undoubtedly dead when attacked. Rarely vertebrates of other classes, a few invertebrates, and carrion constitute the rest of the diet. Birds are rarely taken, reports to the contrary notwithstanding. Of the invertebrates, crayfish and snails are the kinds most commonly eaten, but insects also are important. The food is stalked with imperceptibly slow movements, or by waiting for it to approach within striking distance. The tongue, according to some writers, is used as a lure, by thrusting it out of the mouth as the animal lies in wait for its prey to investigate and venture within striking distance.

Mating occurs at any time of the year except when the animals are in hibernation. The sperm remain viable in the female for several years. Eggs are laid in June, and hatch in August. Some twenty to forty spherical eggs one inch in diameter are laid at a time, in crude, shallow nests scooped by the females in damp soil exposed to the sun. The nests may be half a mile from the nearest water. Muskrat houses not infrequently are used as nests. The hatchlings appear generally to migrate toward the most open horizon, irrespective of humidity gradients, actual direction of water, position of sun or any other possible factors.

In captivity specimens have lived twenty years.

Hibernation begins in October or November and ends in March. The turtles spend the winter in mud usually under water, in muskrat holes, or buried underneath logs and other objects.

Out of water these turtles are vicious, but when submerged they attempt only to escape. On land a safe way to handle one is to grasp its tail and hold the turtle well away from one's self.

The eggs are edible (fried, for they do not harden when boiled), and the flesh is widely used for soup. Few turtles are of greater commercial value.

Kansan Subspecies.—Only one subspecies, *Chelydra serpentina serpentina,* occurs in Kansas. Another subspecies is sometimes recognized in Florida, and still another in Central America.

References.—Carr, 1952: 61-72, pl. 8, map 2 (general account); Pope, 1939:72-83, pls. 18-23 (description, life history, habits, range).

FAMILY EMYIDAE

Genus *Terrapene* Merrem

Carolina Box Turtle

Terrapene carolina (Linnaeus)

Testudo carolina Linnaeus, Syst. Nat. ed. 10, vol. 1, 1758, p. 198 (type locality—Charleston, South Carolina).
Terrapene carolina Bell, Zoöl. Journ., vol. 2, 1825, p. 309.

Range.—Eastern third of state, east of the Flint Hills, and south of the Kansas River. Cragin (1881) recorded the species from as far north and west as the vicinity of Manhattan, Riley County, but the range otherwise is marked by the peripheral localities in Wyandotte (Kansas City), Miami (Pigeon Lake), Franklin (Ottawa), Osage (Melvern, not mapped), Coffey (1 mile west of Agricola), Greenwood (Hamilton) and Montgomery (Havana) counties.

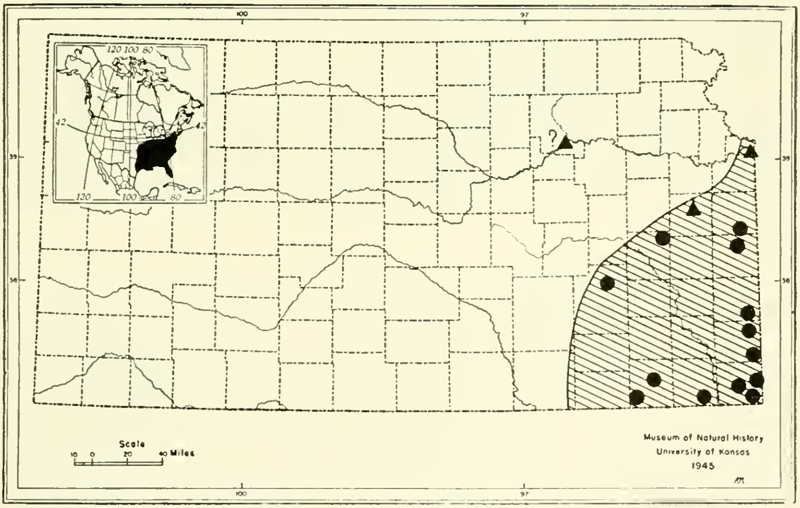


FIG. 95. Distribution of the Carolina box turtle, *Terrapene carolina,* in Kansas, with insert showing range of the species.

Description.—Carapace arched (not flattened on top), with distinct although sometimes discontinuous keel. Plastron with 12 laminae (exclusive of bridge), and consisting of two movable sections hinged across middle of shell and capable of completely concealing all soft parts (head and legs). Each forefoot with five claws, each hindfoot usually with three. Rear feet stumplike, adapted for walking on land and not for swimming.

Dorsal surface tan or brownish, with a variable pattern of yellow spots or streaks radiating from posteromedial part of each scute.

Light marks tend to be relatively broad (nearly as broad as the eye), short, and indistinct, as compared with those of the ornate box turtle. Ventral surface nearly uniform yellowish. Head and forelegs

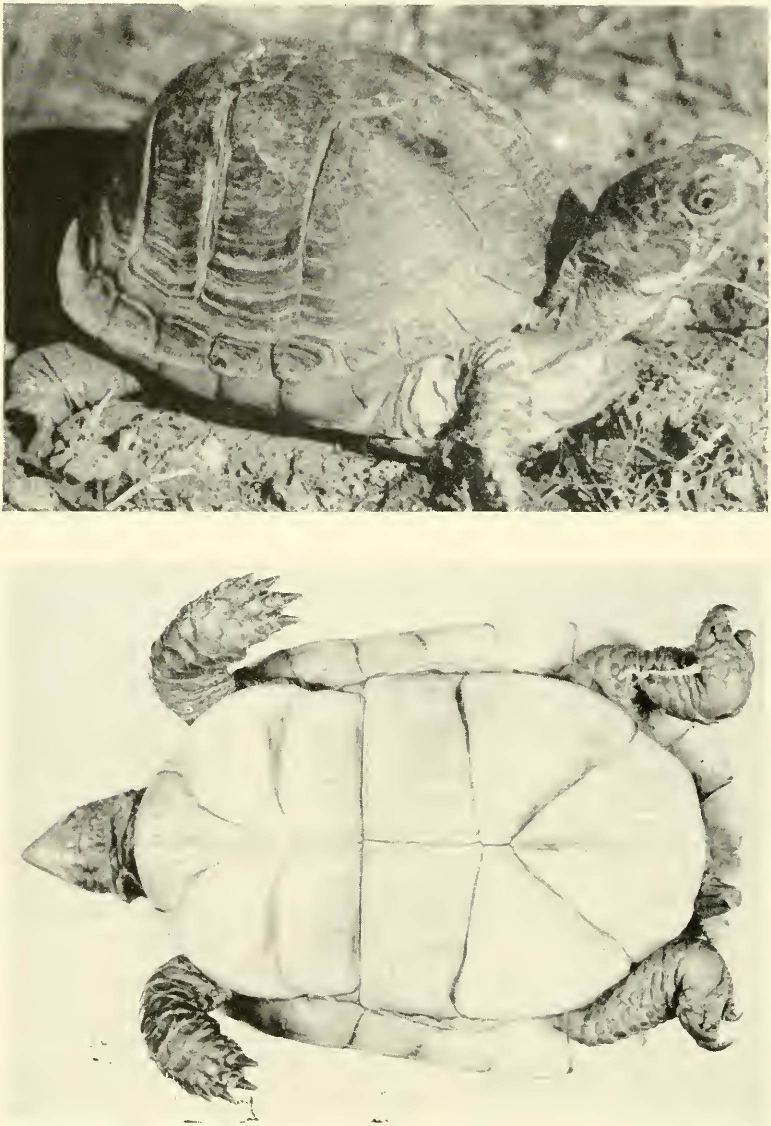


FIG. 96. Carolina box turtles, *Terrapene carolina triunguis*, × ⅘. Above, courtesy Zoölogical Society of Philadelphia. Below, H. M. Smith no. 25, College Station, Brazos County, Texas. Photo by R. R. Hamm.

spotted with orange (males) or yellow (females). Iris of eye of males reddish, in females usually gray.

Size moderate, plastron measuring about five inches in length in the largest specimens.

Recognition Characters.—The single hinge on the plastron (allowing movement of a rear and a front lobe) combined with a uniformly yellow lower shell, serves to distinguish this species from all others in the state. The only other species closely resembling the Carolina box turtle is the ornate box turtle, distinguished by having distinct yellow marks on a brownish plastron and four instead of three claws on the rear feet. The number of toes on the hind foot in the Carolina box turtle is sometimes four instead of the usual three.

Habits and Habitat.—Fields and woods on relatively flat terrain are favored where there is normally a considerable growth of trees. The eastern race *T. c. carolina* is known to be able to swim as well as *Chrysemys picta,* although it is not found in water except in hot dry periods. Whether the Kansan race has like proclivities is unknown.

For the Kansan race no information is on record concerning habits, which presumably resemble those of the eastern race. The food is composed of a large variety of animal and plant material, including, in order of importance, mushrooms, insects, earthworms, slugs, snails, myriapods, dead animals, blackberries, strawberries, and other fruit. Seasonal preferences in kind of food are pronounced.

In the eastern race, mating occurs at any time in the period in which the turtles are active but is most frequent in spring. The eggs, laid in June or early July in the District of Columbia, vary from two to seven, and usually number four in each clutch; they measure, on the average, 33 × 19.5 mm., and are laid and covered in shallow nests dug by the hind legs at night in relatively open spots in loose, moist soil. The excavation of a nest and laying of eggs requires four to five hours. Hatching occurs generally in September, and hibernation immediately ensues without partaking of food. Growth in subsequent seasons is rapid, a carapace length of five inches being reached in five years. Specimens commonly live sixty years, occasionally exceed 100 years, and are said to reach even 123 years of age.

Hibernation is accomplished by degrees, the turtle burrowing deeper and deeper as the season progresses. Final depth depends upon the severity of the winter, and may be as much as two feet. In Kansas in late autumn they frequently are found in burrows of the striped skunk where they presumably go to pass the winter. Sudden and severe cold spells, occurring before the animals burrow deeply, not uncommonly are fatal.

The turtles have a restricted home territory rarely more than a half-mile in diameter. The homing instinct is well developed. Unlike strictly aquatic turtles, they will not drop off high (6 feet) surfaces, and hesitate to walk off surfaces even one foot above lower levels.

Most specimens are docile, but exceptional individuals are more active and bite readily. The bite is not severe.

The flesh is palatable, but a person who dines upon these turtles does so with some risk because the poison of the mushrooms eaten by them—which does not deleteriously affect the turtles—is reported to be transferred undiminished in potency to man who unfortunately is not immune to its effect.

Naturalists resident in Kansas and elsewhere in the range of the western subspecies which occurs in this state could well use the extensive work done upon the eastern subspecies as a guide for similar investigations upon the western race. Casual observations suggest that differences in habits may be numerous. References to two of the more important studies are appended. Of interest is the fact that the only barrier between the two races is the Mississippi River, which seems to be sufficiently effective that no gradual transition, but rather an abrupt change from the characters of one to those of the other race occurs in the vicinity of the river.

One of the most outstanding problems involving the habits of the species (all subspecies) concerns the activities of young individuals less than three inches in length of plastron. Juveniles are so seldom seen that even their natural haunts are uncertain. An even stronger aquatic preference on the part of juveniles than in adults has been suggested.

Aid in maintenance of the chigger population of the country is a curious rôle of this species, shared with most other reptiles of terrestrial habits. Chiggers utilize such a variety of wild animals as hosts, however, that control of them by host elimination is not feasible.

Kansan Subspecies.—Only one, *Terrapene carolina triunguis* (Agassiz), with type locality at New Orleans, Louisiana, occurs in Kansas. Three other races are recognized but they occur only east of the Mississippi River and in southern Louisiana and Texas.

References.—Carr, 1952: 153-156, pls. 28, 29, map 11 (general account); Pope, 1939: 135-136, pl. 39 (description, range, natural history); Allard, 1948 and 1949 (complete life history, based upon data collected over a period of many years).

Ornate Box Turtle

Terrapene ornata (Agassiz)

Cistudo ornata Agassiz, Contr. Nat. Hist. U. S., vol. 1, 1857, p. 445 (type locality—Council Bluffs, Pottawatomie County, Iowa).
Terrapene ornata Baur, Science, vol. 17, 1891, p. 191.

120 100 80
42
120
100
80

Range.—State-wide, except in extreme northeastern and extreme southeastern corners. Not known in the Ozark Plateau region of southeastern Cherokee County, nor in the area north of the line from Washington (6 miles north of Haddam) to Atchison (Effingham) and Leavenworth (Leavenworth) counties.

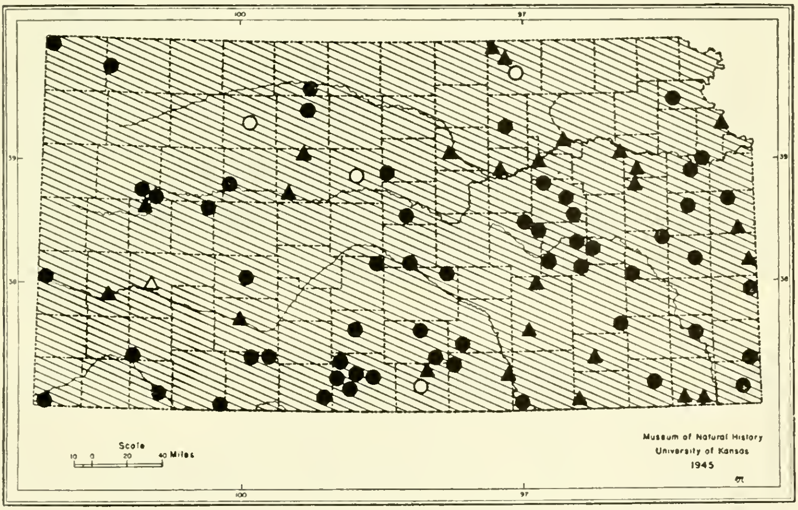


FIG. 97. Distribution of the ornate box turtle, *Terrapene ornata*, in Kansas.

Description.—Carapace high but frequently flattened on top, lacking a keel except in very young. Plastron provided with twelve laminae (exclusive of bridge), and consisting of two movable lobes hinged across the middle of the shell and capable of completely concealing the head and legs. Each forefoot with five claws, each rear foot usually with four. Rear feet stumplike, adapted for walking on land and not for swimming.

Dorsal surface dark brown, usually with a bright pattern of narrow, yellow lines or spots radiating from the posteromedial corner of each plate. The light lines average narrower than those of the Carolina box turtle, and the width of one is approximately half the diameter of the eye. The ventral surface is marked much like the dorsal, with radiating light lines on a dark background. Irregular light areas are present on the head and neck, and more or less rounded light spots on the front of the forelegs; these light spots, as well as the iris of the eye, are reddish in males and yellowish in females.

Size moderate, plastron measuring up to 5⅓ inches in length.

Recognition Characters.—The two ventral lobes of the plastron

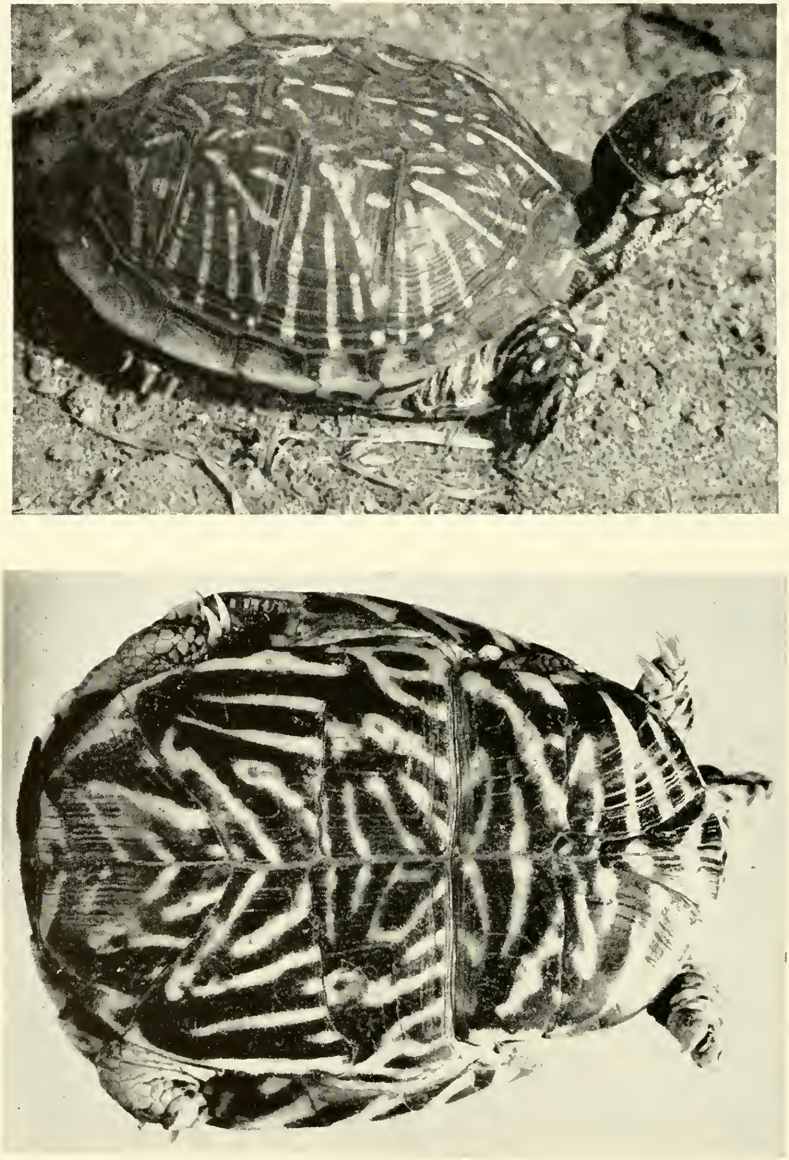


FIG. 98. Ornate box turtles, *Terrapene o. ornata*. Above, Hutchinson, Reno County, Kansas, × ⅘. Courtesy of the Zoölogical Society of Philadelphia. Below, 1½ miles southwest of Stockton, Rooks County, Kansas, × ⅘. Photo by E. H. Taylor and T. P. Lyle.

united by a single transverse hinge, combined with a yellow-marked, dark ventral surface, serve to identify this species and to distinguish it from all other turtles in Kansas. Only one other species in the state resembles it—the Carolina box turtle. See discussion of the latter for comparison.

Hybrid individuals combining the characteristics of both the ornate and Carolina box turtles have authoritatively been recorded in adjacent states, and may rarely be found in Kansas. Normal variation is extensive in both species, however, and extremes not infrequently are labelled erroneously as hybrids. Careful study is required of suspected hybrids to determine their exact identity. Such individuals should be submitted to experts for examination (see p. 24).

Habits and Habitat.—This species usually is found in relatively dry open areas on flat or somewhat hilly terrain. It is most abundant in sandy places, but occurs also in wooded regions at the eastern edge of its range. Moisture requirements sometimes cause *T. ornata* in dry weather to congregate about streams or ponds and often to lie half-buried or completely concealed in the mud or sand near the shore.

The food consists mostly of insects, of which grasshoppers form a conspicuous portion, but may include tender plant material as well.

Mating occurs in May, and eggs are laid as late as the first part of August. The eggs average 36 × 22.5 mm. in size.

T. ornata hibernates earlier and farther below ground than *T. carolina;* presumably *T. ornata* is less resistant to cold.

Although even-tempered, this species will bite upon occasion. The bite is not particularly powerful, but can break skin as tender as that on the back of a man's hand.

In captivity a cage should be provided with sandy soil, shade and sun, a protective retreat, and a low water container. The animals can be fed bits of meat in addition to insects. Regular feeding, once a day, will produce a feeding reflex.

This species can, for the most part, be considered beneficial. In the Dakotas, Indians use it for food, and the practice no doubt could be more widely adopted. The only reported damages wrought by the animals were incurred in their rare attacks upon ripening cantaloupes.

Kansan Subspecies.—*Terrapene o. ornata* is the only subspecies in Kansas. One other, *T. o. luteola,* Smith and Ramsey, occurs in western Texas.

References.—Carr, 1952: 156-162, pl. 30, map 12 (general account); Pope, 1939:139-145, pls. 43, 44 (description, range, natural history); Clarke, 1950:54 (records of aquatic habitats in Kansas); Norris and Zweifel, 1950:1-4 (habits); Rainey, 1953:109-110 (parasitization by fly larvae).

Genus *Graptemys* Agassiz

Map Turtle

Graptemys geographica (Le Sueur)

Testudo geographica Le Sueur, Journ. Acad. Nat. Sci. Phila., vol. 1, pt. 1, 1817, p. 86, pl. 5 (type locality—marsh on the border of Lake Erie).

Graptemys geographica Agassiz, Contr. Nat. Hist. U. S., vol. 1, 1857, p. 436.

Range.—Eastern third of state. Known from only six localities: Anderson (Garnett), Crawford (State Park 3 miles north of Pittsburg), Franklin (Ottawa), Osage (Melvern—not shown on map), Montgomery, Riley (Manhattan), and Wilson counties.

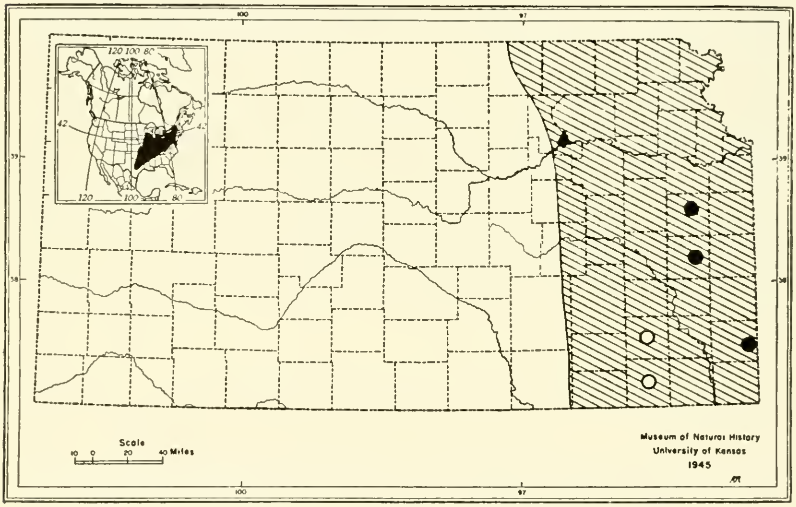


FIG. 99. Distribution of the map turtle, *Graptemys geographica,* in Kansas, with insert showing the range of the species.

Description.—Carapace high, with uneven median keel (highest at back of each scale) in both young and adults, shell not arched but sloping nearly straight away from keel to lateral edge; rear edge of carapace moderately notched; plastron with twelve laminae, absolutely fixed in position (no part movable); hind legs and to lesser extent forelegs greatly widened toward tip as an adaptation for swimming. Jaws smooth-edged externally; upper jaw sometimes with feeble indentation at apex; crushing surface of upper jaw (as seen with mouth open) smooth, not ridged. Lamina in middle of anterior margin of carapace (nuchal lamina) short and broadened posteriorly, less than twice as long as broad.

Carapace dull olive, marked with narrow, yellowish lines of variable distinctness; plastron unmarked, uniform cream-yellow; legs olive, with longitudinal light streaks; neck and head with numerous light-yellow lines extending longitudinally; more or less rounded, small, yellow spot behind eye, separated from eye by distance equal to diameter of spot; light line clearly defined, passing transversely between postocular spot and eye.

Size moderately large, carapace measuring as much as 10¾ inches in a straight line in females, and 5¼ inches in males.

Recognition Characters.—The genus to which this species belongs can be recognized by the combination of characters as follows: plastron with twelve plates and lacking any movable portion (2 characters which exclude all turtles except members of the genera *Chrysemys* and *Pseudemys*); crushing surface of upper jaw (as seen with mouth open) smooth, not ridged (this excludes *Pseudemys*); upper jaw lacking a notch at apex which is *flanked by a projection on either side* (this excludes *Chrysemys*). All except young specimens of *Graptemys* can, with some practice, be distinguished by the possession of a single, median keel (lacking in *Chrysemys* of all sizes but present in young *Pseudemys*). *Chrysemys* can be excluded also by the smooth posterior border of the carapace, which in both *Pseudemys* and *Graptemys* is notched.

The species *Graptemys geographica* can be distinguished most easily from the only other species of the genus (*G. pseudogeographica*) occurring in the state by the pattern on the head, especially that back of the eye. In *G. geographica* a small, isolated light spot back of the eye is separated from the eye by a distance approximately equal to the diameter of the spot, and across that space passes a narrow, transverse light line. In *G. pseudogeographica* the postocular spot is usually much larger, and frequently is crescent-shaped, extending below the eye and even backward on the neck. Sometimes, however, the spot is so reduced in size that confusion with *G. geographica* is possible. Accordingly it is important to observe that the postocular spot in *G. pseudogeographica* is very close to—almost in contact with—the eye, and that there is not sufficient space between the spot and eye for a transverse light line between them as there is in *G. geographica*.

Habits and Habitat.—The preferred habitat is a large, permanent body of water with considerable plant growth and a mud bottom. Marshes, lakes and large rivers meet this turtle's needs.

The food consists almost entirely of snails and clams. The broad, crushing surfaces of the jaws are especially adapted for this diet. The larger the turtle the tougher-shelled the clams and snails which can be eaten. Insects and crayfish are eaten to a lesser extent.

Mating occurs in spring and perhaps in fall. Eggs are laid in late May, June, and early July. Eggs deposited early in the season hatch in August or September, but those laid later may overwinter without hatching until the following spring. The eggs measure approximately 22 × 35 mm. and have soft, white shells. They are laid in shallow excavations dug in soft earth, sometimes as far from water as a quarter of a mile. The female covers the clutch, consisting of from ten to sixteen eggs, carefully and leaves it to fate, without further checking. In fact the only time these turtles leave the water, except for basking, is when the eggs are laid.

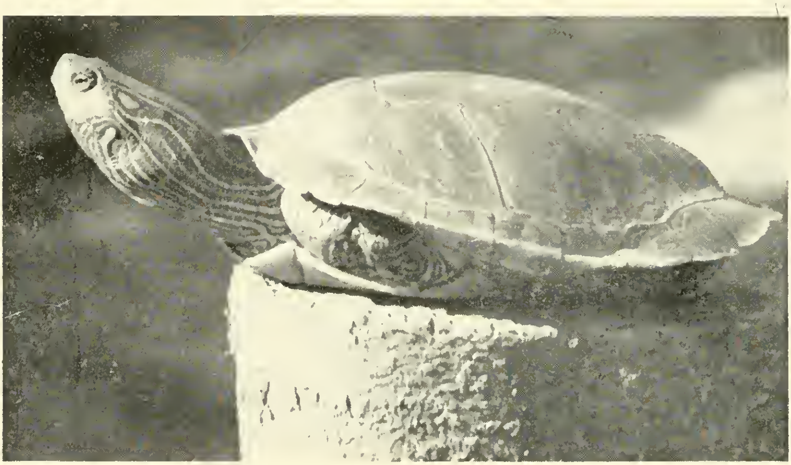


FIG. 100. A map turtle, *Graptemys geographica*, × ⅖. Courtesy of the Zoölogical Society of Philadelphia.

Hibernation may or may not occur, according to the severity of the winter. The turtles may remain feebly active all winter, walking slowly about on the bottom and breathing no air; the skin, pharynx, and cloaca serve as organs for aquatic respiration.

These turtles are extremely shy, and at the slightest disturbance hide in masses of vegetation in the water. They bite when captured, but only upon close approximation of annoying objects; the animals are not vicious. In their natural habitat they bask a great deal, climbing onto the shore, trees or ledges that allow immediate reëntry into the water. They spread their legs and relax completely, giving every indication of enjoyment and inattention whereas they are in reality alert for the slightest indication of danger.

This species is palatable for man but is not commonly eaten.

Kansan Subspecies.—No subspecies have been defined anywhere in the range of this species.

Reference.—Pope, 1939:168-175, pls. 48, 49 (description, range, natural history).

False Map Turtle

Graptemys pseudogeographica (Gray)

Emys pseudogeographica Gray, Syn. Rept., 1831, p. 31 (type locality—Wabash River, New Harmony, Indiana).

Graptemys pseudogeographica Gray, Ann. Mag. Nat. Hist., ser. 3, vol. 12, 1863, p. 180.

Range.—Eastern third of state. A dubious record for "Wallace county" (KU) needs substantiation. There are reliable records from as far west and north as Doniphan (Doniphan Lake), Riley (Manhattan), Shawnee (Topeka), Osage (Long Creek), Coffey (Neosho River), Woodson (Neosho Falls), Wilson and Montgomery (Verdigris River) counties.

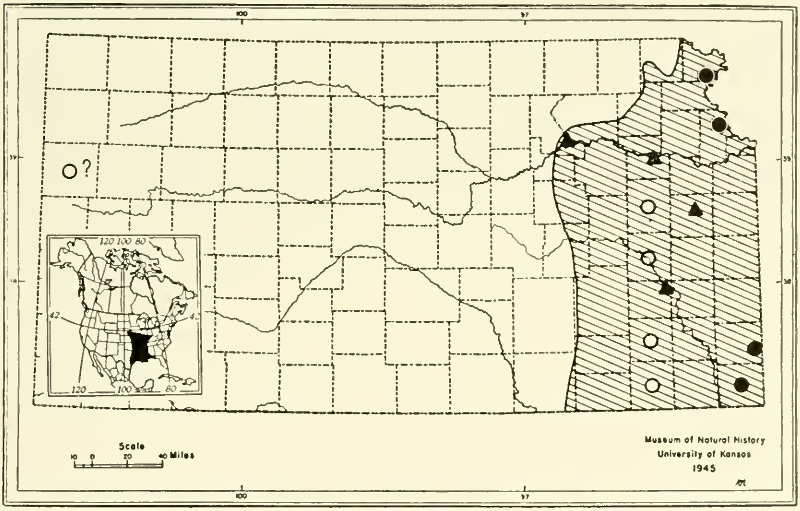


FIG. 101. Distribution of the false map turtle, *Graptemys pseudogeographica*, in Kansas, with insert showing the range of the species.

Description.—The description given of *G. geographica*, applies to this species except for color, size, and the fact that the rear margin of the carapace is strongly, instead of moderately, notched.

Color like that of *G. geographica*, except that the postocular spot is large (generally as broad as, or broader than, eye) and usually is crescent-shaped, curving under the eye. Occasionally the spot is continuous posteriorly near the median line of the neck, or may be a transverse oval. In any case the spot is close to the eye (the distance between is much less than the width of the spot), and there is thus no space for a distinct transverse light line between the spot and eye as in *G. geographica*.

Size moderately large, the carapace reaching a length of ten inches as measured in a straight line (not on the curve of the shell).

Recognition Characters.—See the account of *G. geographica*.

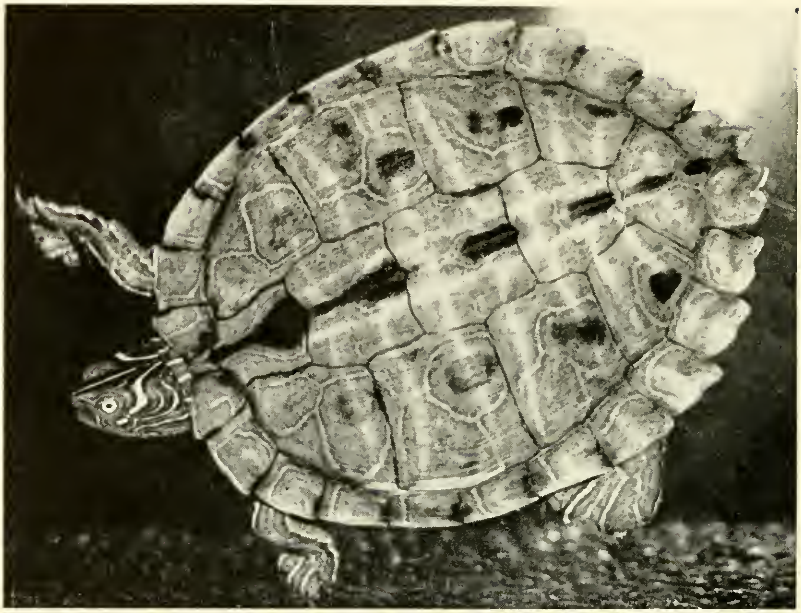


FIG. 102. A false map turtle, *Graptemys pseudogeographica kohnii*, × ⅖. Courtesy of the Zoölogical Society of Philadelphia. This specimen is of the subspecies which occurs in Kansas.

Habits and Habitat.—Both habits and habitat closely correspond to those of *G. geographica* except that the adults are omnivorous. The species is palatable for man and in parts of its range is sold on the turtle market. In Kansas it is not used frequently as food.

Kansan Subspecies.—The race found in this state is *G. p. kohnii* (Gray), the type locality of which is restricted to St. Martinsville, Louisiana. Two other races occur in Texas and south-central United States.

The taxonomic status of the false map turtles of Kansas is not yet established securely. Cagle tentatively recognizes *G. kohnii* as a full species that lives in much of central United States along with *G. p. ouachitensis* Cagle (type locality Harrisonburg, La.), distinguishing the two primarily on the basis of head pattern and head size: *G. kohnii* with a curved, continuous subocular-postocular line (as in Figs. 84D, 102) and a broad head in adult females, *G. p. ouachitensis* with a subrectangular spot behind eye (as in Fig. 84B, C) and narrow head in adult females. The extent of variation I have observed in turtles of this group is so great that I judge every intermediate condition exists and that nowhere do two populations coexist. *G. p. ouachitensis* appears to be a valid geographic race not occurring in Kansas, but it is true that some Kansan specimens resemble that form, others *G. p. pseudogeographica* and *G. p. kohnii*. Since most are of the latter type to that name all Kansan specimens are here referred, pending a more thorough study.

References.—Carr, 1952: 202-207, pl. 38, figs. 13, 15, 16, map 15 (general account); Cagle, 1953: 1-17, figs. 1-3 (taxonomy); Cagle, 1954: 183-186 (in generic key; taxonomy, distribution); Pope, 1939: 175-179, pls. 50, 51 (description, range, natural history).

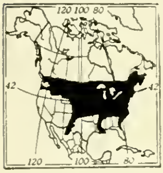
Genus *Chrysemys* Gray

Painted Turtle

Chrysemys picta (Schneider)

Testudo picta Schneider, Naturg. Schildkr.. 1783, p. 348 (type locality—Lancaster, Pennsylvania).
Chrysemys picta Gray, Cat. Shield Rept. Brit. Mus., pt. 1, 1856, p. 32.

Range.—State-wide except perhaps the southwestern corner. Not yet recorded west of a line from Meade (State Park) through Ford (2 miles south of Bucklin), Scott (State Park), and Logan (Vincent Ranch, extreme northwest corner) to Cheyenne (23 miles by road northwest of St. Francis) counties.



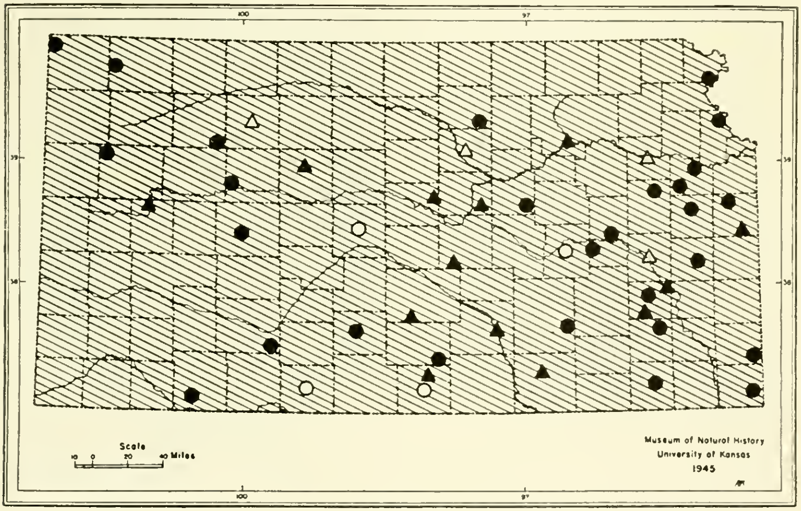


FIG. 103. Distribution of the painted turtle, *Chrysemys picta,* in Kansas.

Description.—Carapace not arched (but slightly flattened), completely lacking longitudinal keels, with posterior edge smooth (not at all notched); plastron completely fixed, with no movable part, and composed of twelve laminae; hind legs somewhat broadened, adapted for swimming. As seen in the open mouth, crushing surface of upper jaw smooth and not ridged; apex of upper jaw with sharp notch flanked on either side by a projection. Claws on forefeet of males long, presumably modified for the special courtship practiced by this species (see discussion under *Habits and Habitat*).

Slate gray above; carapace with fine, irregular, yellow border which joins narrow light line passing through center of each marginal plate; marginal lines continuous in turn with irregular, coarse network of light lines which become faint toward middle of carapace; middle of plastron dark, with dark extension outward on each suture between plates; limbs and head with a number of light lines somewhat wider than those on carapace.

Size moderate, carapace measuring as much as ten inches in a straight line.

Recognition Characters.—This species can be recognized by the combination of the following characters: Plastron with no movable part and provided with twelve laminae; notch at apex of upper jaw flanked on either side by toothlike projection; posterior margin of upper shell perfectly smooth, not notched. Most easily confused with this turtle are the several species of the genera *Pseudemys* and *Graptemys*, in which the posterior margin of the carapace is notched, and the upper jaw does not have a tooth-flanked notch at its apex; *Graptemys* moreover has no ridge on the middle of the crushing surface of the upper jaw (as seen with the mouth open); and specimens of all ages of *Graptemys* have a median longitudinal ridge down the back.

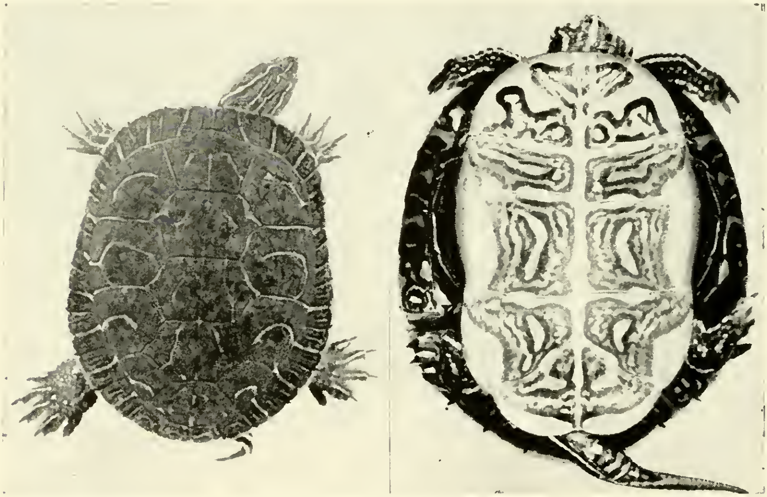


FIG. 104. Painted turtles, *Chrysemys picta bellii.* Left, K. U. no. 24393, 4 miles east and 1 mile north of Baxter Springs, Cherokee County, Kansas, × ⅖. Right, 1½ miles southwest of Stockton, Rooks County, Kansas, × ⅗. Photos by E. H. Taylor and T. P. Lyle.

Habits and Habitat.—Shallow, warm waters, with some plant growth, such as ponds, ditches, streams, lakes, and still pools in rivers, are inhabited. Surprisingly, stagnant and polluted waters sometimes are inhabited.

The food consists about half-and-half of plant and animal material. The plant matter is mostly algae and leaves, and the animal matter primarily insects, with smaller amounts of Mollusca and vertebrate animals. The latter are not killed by these turtles but are eaten after death has been caused by some other agency. The scavenger habit is pronounced.

Mating occurs in spring and fall. In courtship the male swims backward in front of the female, facing her as she swims forward. From time to time he slows, allows her to approach, then stretches his forelimbs forward, vibrating them rapidly on the chin and sides of the snout of the female. This activity may continue for a quarter of an hour or longer before copulation occurs.

Eggs are laid in June and early July, generally in late afternoon or early evening. They number from five to fifteen, are white and measure 28 to 32 mm. long and 17 to 20 mm. thick. They are laid in nests, in which they are adroitly covered. The nests are dug by use of the hind legs and may be several hundred yards from water. At the site chosen, the female digs diligently, alternately with the hind feet, pushing the dirt back from time to time by sliding backward while the forefeet remain fixed—as they do during the entire nesting process. The soil is dampened from time to time by release of fluid from the bladder; several species of turtles are known to have this habit. As much as two hours may be occupied in digging and covering the nest.

Eggs hatch in approximately seventy-two days. The egg-tooth, although present, is useless in this process. If the hatching occurs late in the fall the young may not emerge from the nest until the following spring. In some nests eggs laid in one year do not hatch until the following spring. The newly hatched turtles find water by virtue of their instinct to move toward the source of greatest illumination.

The turtles hibernate in mud at the bottom of the bodies of water in which they live. They enter hibernation in late October or early November and emerge in April.

In captivity these turtles have lived to be 11¼ years old. They tame readily, will learn to eat from the fingers, and are hardy vivarium inmates. Although these turtles may be eaten by man, they are not popular on the market.

Kansan Subspecies.—*Chrysemys picta bellii* (Gray), the type locality of which is Puget Sound, Washington, is the race that occurs in Kansas. Three other races are known in the eastern United States.

References.—Carr, 1952: 219-224, pl. 41, map 16 (general account); Legler, 1954: 137-144 (nesting habits); Pope, 1939:184-203, pls. 56, 57 (description, range, natural history).

Genus *Pseudemys* Gray

Saw-toothed Slider

Pseudemys floridana (Le Conte)

Testudo floridana Le Conte, Ann. Lyc. Nat. Hist., New York, vol. 3, 1830, p. 100 (type locality—St. John's River, Florida).

Pseudemys floridana Baur, Proc. Amer. Philos. Soc., vol. 31, 1893, p. 223.

Range.—Southern half of eastern third of state. Known from only five localities in Greenwood ("Holmer creek south of Hamilton on State Highway 99"), Wilson (northeast of Neodesha), Woodson (5½ miles northeast of Coyville; Neosho Falls), Bourbon (5 miles west of Fulton) and Miami (Murray Lake) counties.

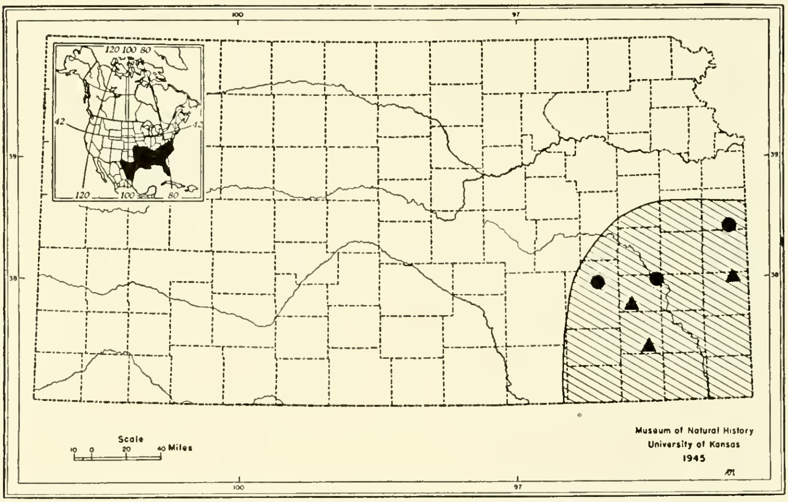


FIG. 105. Distribution of the saw-toothed slider, *Pseudemys floridana*, in Kansas, with insert showing range of the species.

Description.—Young with prominent median longitudinal keel on carapace, but this keel absent in subadults and adults; plastron fixed, with no part movable, and provided with twelve laminae. Limbs, especially hind legs, conspicuously broadened toward tip, adapted for swimming; claws on forefeet long in males (correlated with breeding habits). Crushing surface of upper jaw, as seen in open mouth, with high, toothed ridge; upper jaw sometimes notched at tip but notch, if present, not flanked by conspicuous toothlike projections as in *Chrysemys;* lower jaw with sharp projection ("tooth") at apex, and feebly serrate at edge.

Carapace with complicated network of yellow lines on dark-slate ground color; limbs with narrow yellow lines; lines on head nar-

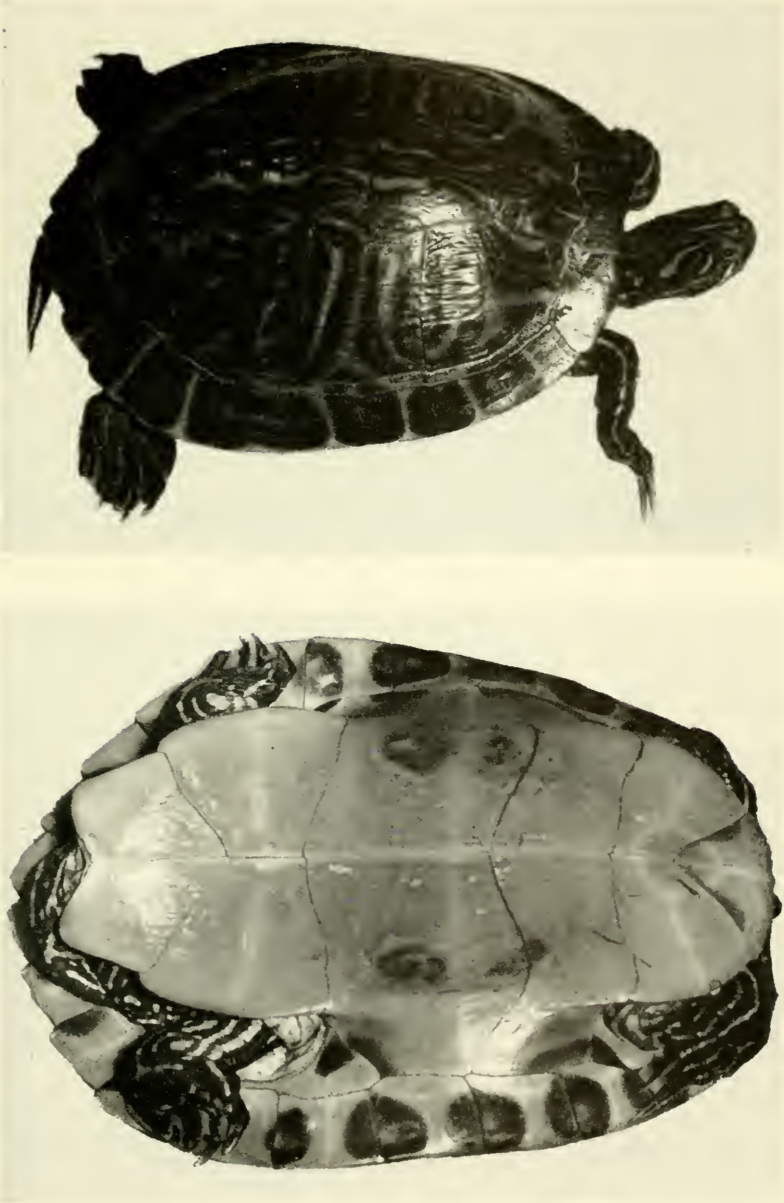


FIG. 106. A saw-toothed slider, *Pseudemys floridana hoyi*, × ⅓, from Harris County, Texas. Courtesy Louis A. Ramsey.

row above, broad below; lines radiating backward from eye narrow, not expanded; plastron cream, unmarked or with seven vaguely defined dark areas (three on each side, one anterior) except in young, which have an irregular, narrow, longitudinal dark marking.

Size moderately large, carapace measuring as much as fifteen inches in a straight line.

Recognition Characters.—The genus *Pseudemys* can be recognized by the following combination of characters: plastron fixed and lacking any movable part, provided with twelve plates; and crushing surface of upper jaw with a conspicuous longitudinal ridge evident in the open mouth. The first character eliminates all but the genera *Chrysemys* and *Graptemys.* The latter genus can be distinguished from all except young *Pseudemys* by, in addition to the character mentioned above, the presence of a strong keel. *Chrysemys* is distinctive in having a notch flanked by teeth at the apex of the upper jaw, and in having the posterior margin of the carapace smooth and not at all notched. The two most conspicuous differences between the two species of *Pseudemys* occurring in Kansas (*P. floridana* and *P. scripta*) are the pattern of the head and the character of the crushing surface of the upper jaw. In *P. floridana* the ridge on the crushing surface of the upper jaw is strongly toothed, while in *P. scripta* it lacks teeth. The latter species, in Kansas, has a broad light line extending posteriorly from the eye; the width of the line is as great as the diameter of the eye. In *P. scripta* none of the lines extending backward from the eye are particularly broad; their width does not exceed about one-half the diameter of the eye.

Habits and Habitat.—Completely aquatic, this species is at home in permanent bodies of still or slow-moving shallow water. A soft bottom and plenty of vegetation is preferred.

These turtles are almost completely carnivorous, eating insects, crayfish, tadpoles, and small fish. They act as scavengers. Some aquatic plants are eaten.

The mating habits are like those of *Chrysemys,* as probably also are the nesting habits. The eggs, not definitely known, are thought to measure approximately 26 × 38 mm. and to be laid in early June in clutches of 9 to 19.

Turtles of this species are extremely wary, although they delight in sunning themselves either on objects in the water or at the surface of the water itself.

Kansan Subspecies.—*Pseudemys floridana hoyi* (Agassiz), with type locality at Springfield, Missouri, is the race in Kansas. Seven other races are known in the eastern and southern United States, and extreme northern Mexico.

References.—Carr, 1952: 307-311, pl. 58, figs. 19, 20, map 19 (natural history, description, range); Pope, 1939:205-215, pls. 60-70 (natural history).

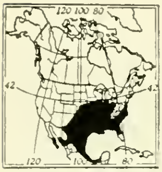
Elegant Slider

Pseudemys scripta (Schoepff)

Testudo scripta Schoepff, Hist. Testud., pts. 1-2, 1792, p. 16, pl. 3, figs. 4, 5 (type locality—Charleston, South Carolina).

Pseudemys scripta Jordan, Man. Vertebr. Anim. North. U. S., ed. 8, 1899, p. 209.

Range.—Southeastern half of state, south and east of a line from Doniphan (Doniphan Lake), Ottawa, Reno (2 miles south of Lerado), Pratt (Pratt), and Clark (Stephenson Ranch, 6 miles south of Kingsdown) to Meade (State Park) counties. A dubious record for "Wallace County" (KU) needs verification.



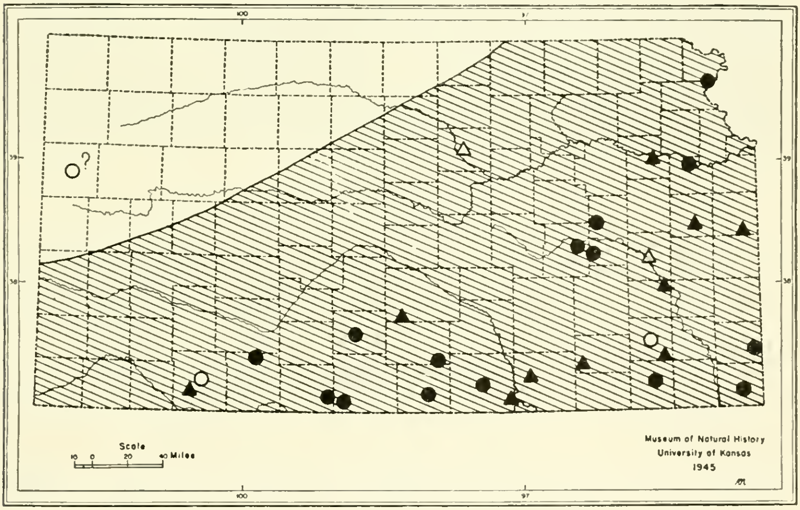


FIG. 107. Distribution of the elegant slider, *Pseudemys scripta*, in Kansas.

Description.—Young with prominent median longitudinal keel on carapace, but keel absent in subadults and adults; lower shell completely fixed, with no movable portion, and provided with twelve laminae. Limbs, especially posterior pair, conspicuously broadened toward tip, adapted for swimming; claws on forefeet exceptionally long in males (correlated with breeding habits). Crushing surface of upper jaw, as seen in open mouth, with high, smooth (not toothed) ridge; outer edge of jaw even; apex of upper jaw sometimes with a notch, but latter never flanked by a projection on either side; lower jaw lacking apical beak.

Carapace with rather dim light lines, the most conspicuous of these extending through middle of costal and marginal plates; adult males lose this pattern and instead develop dark lines along sutures between plates; these lines expand with age until entire carapace may be black. Each plate on ventral surface with a large, circular dark mark, which becomes fainter in adults and almost completely disappears in adult males. Limbs and head with conspicuous yellow lines; most conspicuous line on head begins at upper rear corner of eye, passes backward, becoming very broad, and terminates abruptly near posterior margin of head.

Size moderately large, plastron measuring as much as 10 $^{7}/_{16}$ inches in length.

Recognition Characters.—See account of *P. floridana.*

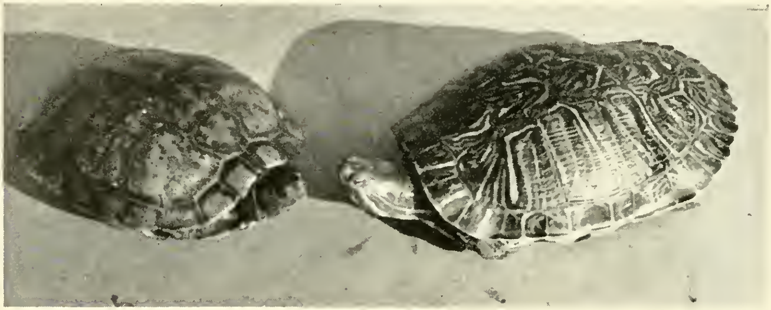


FIG. 108. Elegant sliders, *Pseudemys scripta elegans*, × $^{1}/_{6}$, Reelfoot Lake, Tennessee. Left, male; right, female. Courtesy of the Zoölogical Society of Philadelphia.

Habits and Habitat.—Permanent bodies of water are inhabited, such as lakes, rivers, creeks, large ponds and marshes. Still waters with mud bottoms are preferred.

The food is mostly animal matter, including insects, snails, crayfish, tadpoles, small fishes and various dead animals. Some aquatic plants are eaten.

The courtship of this species is like that of *Chrysemys*, and may occur either in spring or fall. Egg-laying follows some two weeks after mating. An average of ten (5 to 22) eggs are laid in June or early July, in a nest closely resembling that of *Chrysemys.*

Six to eight years are required to reach maturity (breeding state).

Animals of this species are inoffensive and shy, but upon capture they go through the motions of swimming, even in the air, and may half-heartedly attempt to bite.

In parts of some other states man makes important use of these turtles as food.

Kansan Subspecies.—*Pseudemys scripta elegans* (Wied), whose type locality is the Fox River at New Harmony, Indiana, is the race occurring in Kansas. Five other races are known from the eastern United States and the region south to Panamá.

Reference.—Pope, 1939:224-233, pls. 79, 80, 81 (description, range, natural history).

FAMILY TRIONYCHIDAE

Genus *Amyda* Schweigger

Smooth Soft-shelled Turtle

Amyda mutica (Le Sueur)

Trionyx muticus Le Sueur, Mém. Mus. Hist. Nat. Paris, vol. 15, 1827, p. 263, pl. 7 (type locality—Wabash River at New Harmony, Indiana).

Amyda mutica Agassiz, Contr. Nat. Hist. United States, vol. 1, 1857, p. 399, vol. 2, pl. 6, figs. 6-7.

120 100 80
42
120
100
80

Range.—Eastern two-thirds of state, south and east of a line from Doniphan (Doniphan Lake) through Trego (Wakeeney), McPherson (Lindsborg), Reno (6 miles east of Turon), Gray (1 mile west of Cimarron; not mapped) and Barber (Aetna) counties.

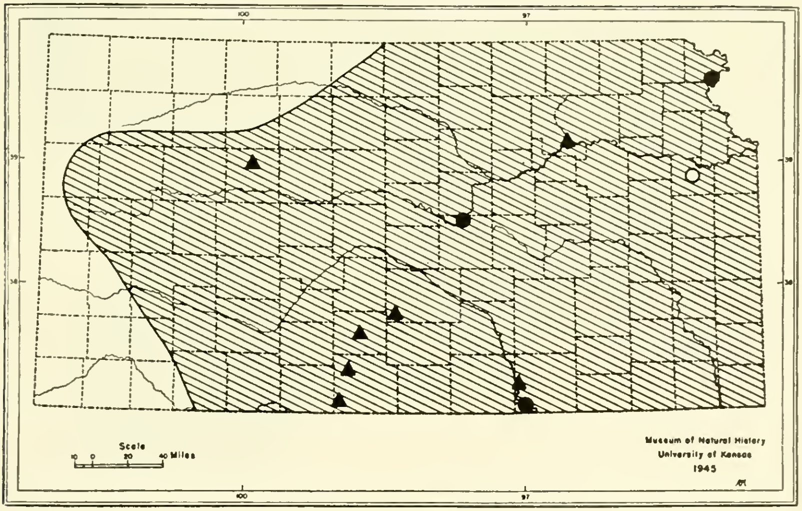


FIG. 109. Distribution of the smooth soft-shelled turtle, *Amyda mutica*, in Kansas.

Description.—Shell leathery, without laminae, although bone is "visible" centrally; carapace completely devoid of tubercles; limbs, especially the rear ones, adapted for swimming. Nostrils rounded, lacking a ridge projecting from median septum into nasal cavities.

Adults uniform light or dark brown above, unmarked; head dark above, light below; lower surfaces cream-white. Young light brown above, with pale, yellowish margin around sides and rear part of carapace in turn bordered medially by narrow dark line; small dark flecks may be present on back; light, dark-edged band extending from eye onto neck, and at least a short distance (sometimes to snout) anteriorly from eye; sometimes small dark flecks on sides and upper surfaces of neck, and on forelegs.

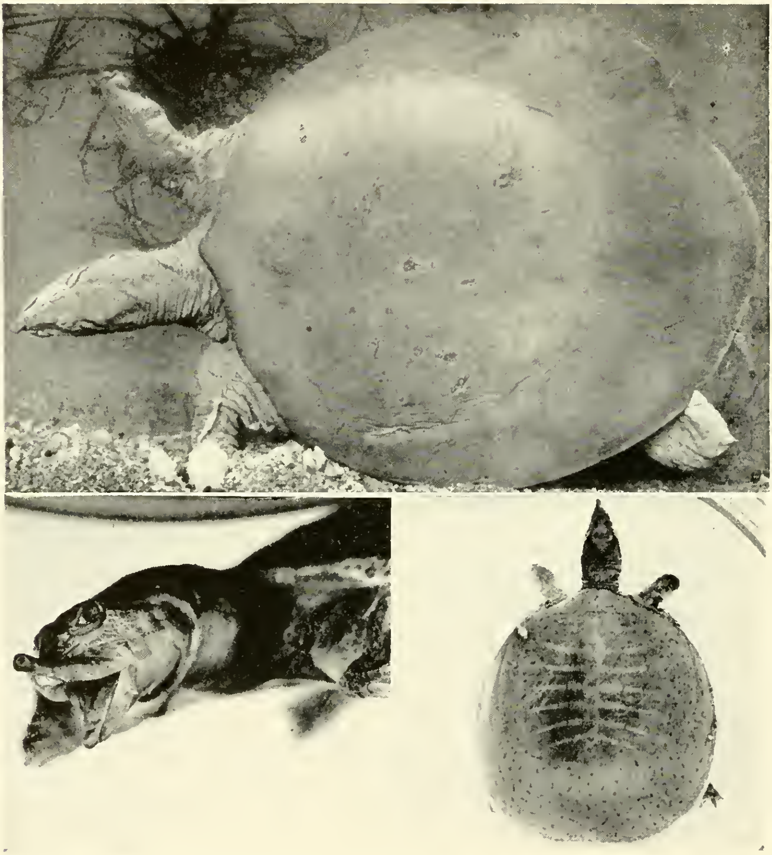


FIG. 110. Smooth soft-shelled turtles, *Amyda mutica*. Above, courtesy New York Zoölogical Society, × $^4/_9$. Below right, Lage Texoma, Grayson County, Texas, × $^3/_5$. Below left, snout of same, approx. × $1^1/_5$.

Size moderately large, carapace measuring as much as eleven inches in length.

Recognition Characters.—The soft-shelled turtles are easily recognized by the flexible, leatherlike edges of the shells, and absence of laminae covering the body. The only difficulties arise in distinguishing the two Kansan species from each other. *A. mutica* lacks the ridge projecting to each side from the median nasal septum into the nasal cavities, which ridge is present in *A. ferox* and easily seen by looking directly at the end of the snout. Moreover *A. mutica* completely lacks the spines and tubercles at the front end of the carapace, so characteristic of *A. ferox;* these tubercles are not clearly evident in young specimens of *A. ferox*.

Habits and Habitat.—These are typically river and stream turtles, although they are found in nonstagnant lakes. Waters with mud bottoms and aquatic vegetation are preferred.

The food consists of insects, worms, crayfish, snails, clams, frogs, tadpoles, fishes, perhaps young birds, fruit, nuts and potato stems. These turtles are the best swimmers of all freshwater turtles, and perhaps of any turtles, and can catch even such piscatorial experts as trout. Even on land these turtles are said to be remarkably swift.

Some ten to thirty-one eggs are laid in June and incubate in about seventy days. They measure approximately 23 mm. in diameter and have thick, white shells. The female scoops out a nest in plain sight of the water, and not more than sixty feet from it or nearer than ten feet to it. Sandy soil of just the right dampness so that the particles will cling together, and lacking any cohesive foreign matter such as clay, is required.

These turtles are vicious and difficult to handle because the long, snakelike neck allows great freedom of movement for the head which can be moved rapidly, and enables the powerful jaws to grasp an adversary. The least hazardous way to manage one of these turtles is to hold it by the tail.

These turtles spend hours at the edge of streams, buried under a thin layer of sand in water just deep enough to permit the nostrils to reach the air when the animal stretches its neck. In such a situation it is almost impossible to see one. While unbelievably shy and wary, the turtles sun themselves to some extent on beaches near water. For food this is one of the best of all turtles.

Kansan Subspecies.—No subspecies have been defined anywhere in the range of this species.

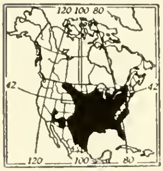
References.—Carr, 1952: 436-440, pl. 79, map 23 (general account); Pope, 1939: 318-323 (description, range, natural history).

Spiny Soft-shelled Turtle

Amyda ferox (Schneider)

Trionyx ferox Schneider, 1783, Naturg. Schildkr., p. 330 (type locality—Savannah River, Georgia).

Amyda ferox Oken, Lehrb. Zoöl., vol. 2, 1816, p. 348 (but Oken's names and combinations are in question as to availability).



Range.—State-wide, except entire northern border and perhaps extreme southwestern corner. Not recorded north of Doniphan (Doniphan Lake), Riley (Manhattan), Sheridan (7 miles northeast of Quinter) and Wallace counties. Not recorded south and west of a line from Meade (State Park) to Hamilton (Syracuse) counties.

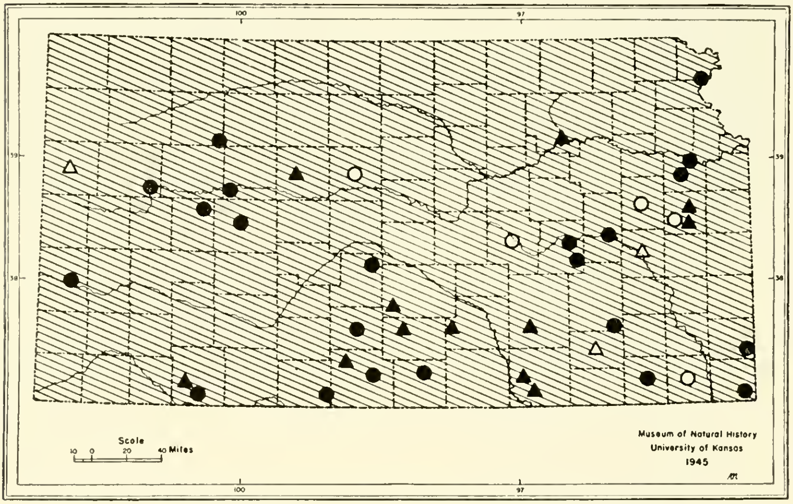


FIG. 111. Distribution of the spiny soft-shelled turtle, *Amyda ferox*, in Kansas.

Description.—Shell leathery, without laminae, although bone is "visible" centrally; tubercles or spines present at front margin of upper shell, very low in young and several millimeters long in adults; limbs adapted for swimming. A ridge projecting from each side of septum between nostrils into the nasal cavities.

Adults uniformly light or dark brown above, unmarked; head dark above, light below; lower surfaces creamy white; in young carapace dark spotted and light bordered; inside the light border is narrow dark ring; light line through eye.

Size moderately large, carapace measuring as much as fourteen inches in length.

Recognition Characters.—See account of *A. mutica.*

Habits and Habitat.—Rivers and streams are the usual habitat, where soft bottoms are available. Well-drained lakes and ponds may be inhabited, but temporary waters are shunned.

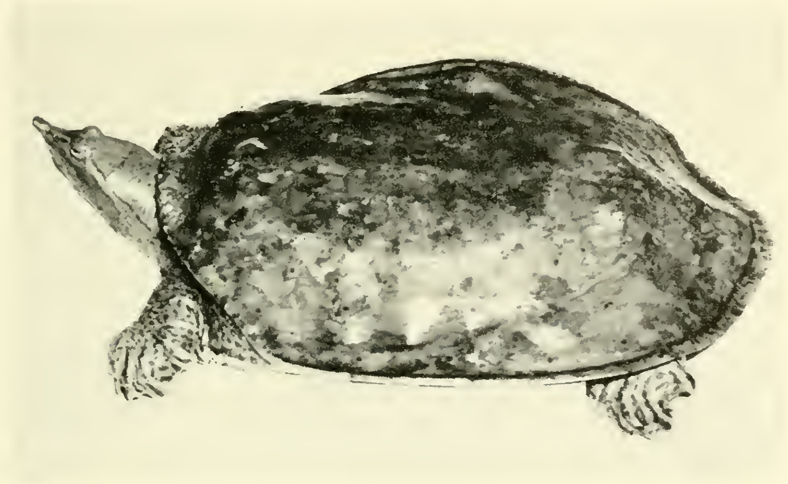


FIG. 112. A spiny soft-shelled turtle, *Amyda ferox spinifera*, × ⅓, from Champaign, Illinois.

The food consists mostly of crayfish, but also of many other items such as insects, snails, worms, frogs, tadpoles, clams, small fishes and grains of corn. In seeking food "they crawl or swim along the bottom, thrusting their snouts under stones and into masses of vegetation, occasionally snapping up a crayfish or larva that they have succeeded in dislodging." (Newman, 1906.)

Twelve to twenty-five, generally eighteen or nineteen, eggs of usually spherical shape, approximately 26 mm. in diameter, are laid in June and hatch in the fall. The female follows much the same procedure as other turtles in constructing the nest, but usually makes it within twenty-five feet of water, and is extremely wary during the entire process (most other turtles are not easily disturbed at that time). "The nest is flask-shaped, ranging in depth from four to ten inches, in greatest diameter from three to five inches, and with a narrow neck around one and one-half inches in diameter" (Carr, 1952:429).

Females reach sexual maturity when 9½ inches long—a length attained probably at six or seven years of age.

Hibernation begins in late October, and the turtles emerge in April or May. They hibernate under a few inches of mud or sand covered by water.

They sun themselves on open beaches in summer, but always remain close to the water and highly alert to any indication of danger. They float at the surface of the water for hours, and also lie in shallow water barely covered by sand or mud flipped onto the back by the feet or into which the body is sidled. Often specimens may be found on sandy beaches in the hottest parts of summer days by probing into depressions where they have dug near water. They live under water for hours by practicing aquatic respiration with use of the highly vascularized interior of the throat and esophagus. The adaptive value of the soft-margined flat shell of *Amyda* seemingly is not so much a provision for speed in aquatic locomotion (although these turtles are said to overtake bass), as it is a means by which the turtle may easily conceal itself.

The disposition of these turtles is notoriously fierce. They snap and strike long distances with great speed and precision, so that they can safely be handled only by the tail. Strangely, the eyes are kept uppermost when striking at objects behind them. For some time after capture they retain their sour disposition, but eventually submit to captivity and have survived 10½ years under artificial conditions.

The flesh of this and *A. mutica* is the most delicious of any Kansan turtles. The soft-shelled turtles have never been of commercial importance, however, because of rarity of capture.

According to Carr (1952: 431), "The importance of this soft-shell as an enemy of valuable fishes has not been demonstrated and probably is not nearly so great as is popularly supposed. It quite possibly is of more significance as a competitor with game fish than as an enemy, since the preponderance of crayfish in its diet implies a dependence on a partly similar food supply."

Kansan Subspecies.—*A. f. hartwegi* Conant and Goin is the race in Kansas. Its type locality is at Wichita, Kansas. Five others occur in the eastern United States.

References.—Carr, 1952: 433-435, pl. 78, map 22 (general account); Pope, 1939:307-318 (description, range and natural history; Pope's plates for this species actually illustrate another subspecies, *A. f. aspera*).

ORDER SQUAMATA Oppel

Lizards

Suborder SAURIA Macartney

Fourteen species, two of which are represented by two subspecies, are known to occur in the state. They represent four families. One other species, a skink of the genus *Eumeces*, is to be expected in the state (see p. 321).

KEY TO SPECIES OF LIZARDS

1. Body limbless .... *Ophisaurus attenuatus*, p. 207

1′. Body with 4 limbs.

- 2. Scales around middle of trunk numbering 35 or more, differing markedly in size and shape.
  - 3. Posterior border of head provided with horns (Fig. 113).
    - 4. Spines at rear of head (occipitals) about twice as long as those at sides of head, 3 times as large as those back of eye (Fig. 113A); 2 fringes of elongate scales on each side of trunk; chinshields increasing in size posteriorly. *Phrynosoma cornutum*, p. 181
    - 4′. Spines at rear of head about same size as those at sides of head, and less than twice as large as those back of eye (Fig. 113B); 1 fringe of elongate scales on each side of trunk; chinshields decreasing in size posteriorly. *Phrynosoma douglassii*, p. 184

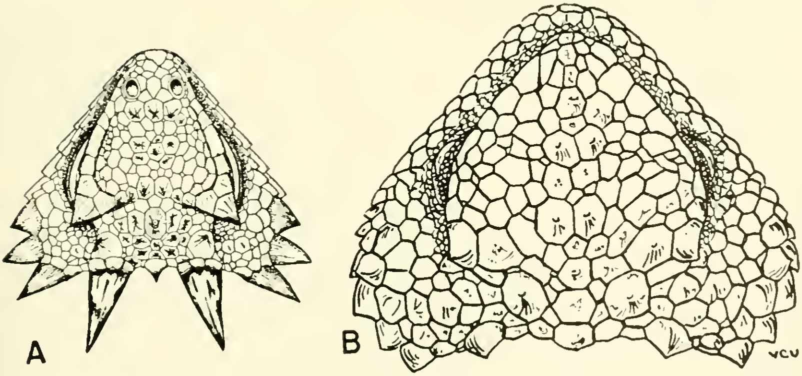


FIG. 113. Dorsal views of the heads of horned lizards. A. Texan horned lizard, *Phrynosoma cornutum*, × 1½, from Burt (1935). B. Short-horned lizard, *Phrynosoma douglassii*, × 4, K. U. no. 21451, 16 miles southwest of Marsland, Box Butte County, Nebraska. Drawn by Mrs. Virginia C. Unruh.

  - 3′. Head without horns.
    - 4. No ear opening; tympanic membrane invisible. *Holbrookia maculata*, p. 171
    - 4′. Ear opening present; tympanic membrane visible.

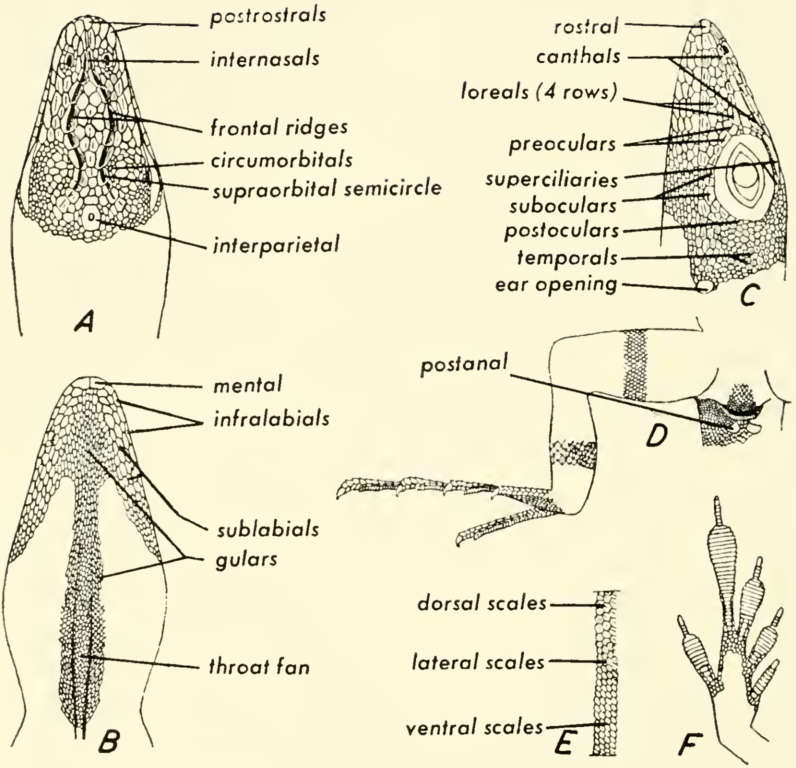

postrostrals
internasals
frontal ridges
circumorbitals
supraorbital semicircle
interparietal
A
rostral
canthals
loreals (4 rows)
preoculars
superciliaries
suboculars
postoculars
temporals
ear opening
C
mental
infralabials
sublabials
gulars
throat fan
B
postanal
D
dorsal scales
lateral scales
ventral scales
E
F

FIG. 114. Typical scutellation in an anole, *Anolis carolinensis*, × 2, locality unknown. A. Top of head. B. Under side of head. C. Side of head. D. Ventral view of right hind leg and anal region. E. Section of body in lateral view. F. Ventral view of hind foot. From Cope, after Smith (1946).

5. Part of fingers and toes expanded, padlike; scales granular above, small below; no fold across lower surface of neck, but a longitudinal flap (throat fan) present in males (Fig. 114) . . . . *Anolis carolinensis*, p. 168

5′. Fingers and toes of nearly uniform diameter throughout, never expanded; all scales large, or at least the lower scales considerably larger than the upper; no longitudinal throat flap.

  6. A granular fold across lower surface of neck; scales on back granular.

    7. Belly scales large, abruptly differentiated from dorsal scales (Fig. 115A); fewer than 15 rows of scales across middle of belly. *Cnemidophorus sexlineatus*, p. 204

    7′. Belly scales small, gradually merging with the dorsal scales; more than 15 rows of scales across middle of belly . . . . *Crotaphytus collaris*, p. 174

  6′. No fold across neck; dorsal scales large, keeled, strongly pointed, overlapping . . . . *Sceloporus undulatus*, p. 176

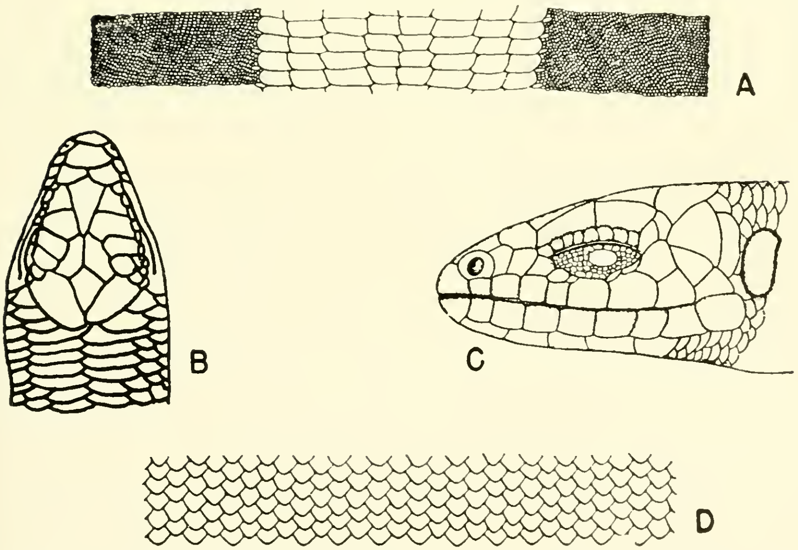


Fig. 115. A. A strip of scales around middle of body, split at middorsal line, of a six-lined racerunner, *Cnemidophorus sexlineatus*, × 2, from Burt (1935). B. Dorsal view of head of a brown skink, *Scincella laterale*, × 2½, from Imboden, Lawrence County, Arkansas. C. Lateral view of head of same species, locality unknown, from Burt (1935). D. A strip of scales around middle of body, split at middorsal line, of a skink, *Eumeces tetragrammus*, × 2, from Burt (1935).

2.′ Scales around middle of trunk numbering 30 or less, all of uniform size and shape, and relatively large, absolutely smooth, shiny and overlapping (Fig. 115D).

  3. Frontal V-shaped, rear part much narrower than forepart (Fig. 115B); lower eyelid with a single fairly large, windowlike scale (Fig. 115C); supranasals absent . . . . *Scincella laterale*, p. 186

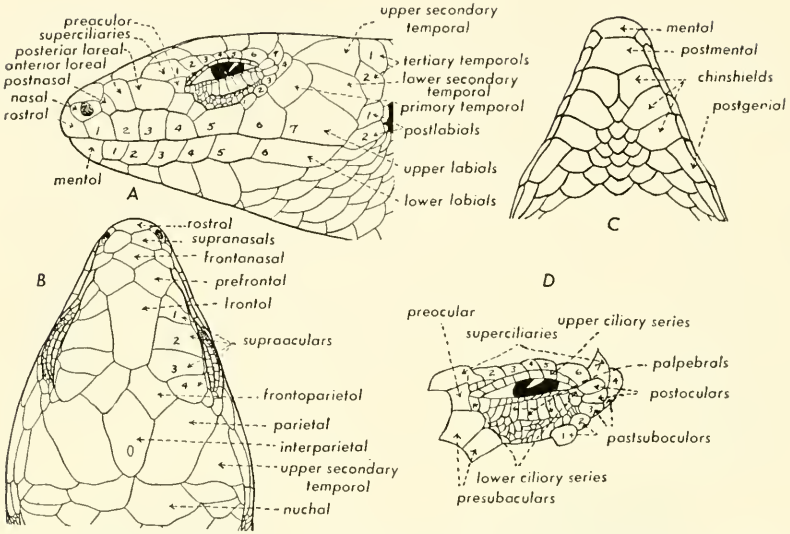

preocular
superciliaries
posterior loreal
anterior loreal
postnasal
nasal
rostral
mental
A
upper secondary temporal
tertiary temporals
lower secondary temporal
primary temporal
postlabials
upper labials
lower labials
mental
postmental
chinshields
postgenial
C
rostral
supranasals
frontonasal
prefrontal
frontal
supraoculars
frontoparietal
parietal
interparietal
upper secondary temporal
nuchal
B
D
preocular
superciliaries
upper ciliary series
palpebrals
postoculars
postsuboculars
lower ciliary series
presuboculars

FIG. 116. Typical scutellation in a skink, *Eumeces*, species not determined. A. Side of head, × 2 7/10. B. Top of head, × 2 7/10. C. Under side of head, × 2 7/10. D. Orbital region in lateral aspect, × 4. From Taylor, after Smith (1946).

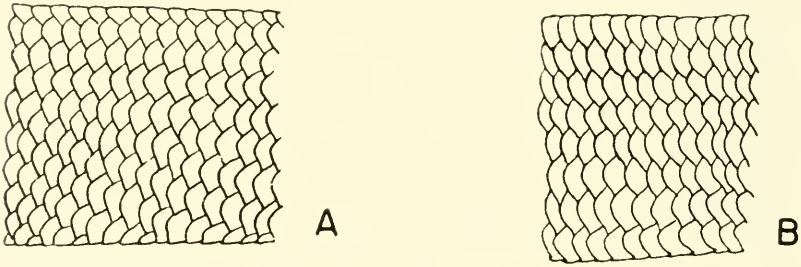


FIG. 117. A section of the side of the body. A. Sonoran skink, *Eumeces obsoletus*. B. Common five-lined skink, *Eumeces fasciatus*. Both drawings × 3.

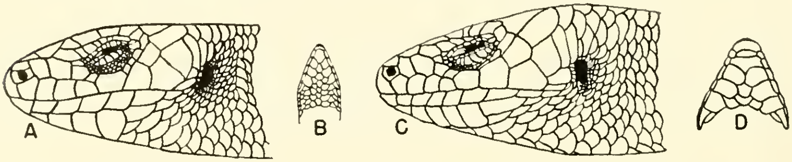


FIG. 118. A. Lateral view of head of a coal skink, *Eumeces anthracinus*, × 1¾, K. U. no. 8221, Imboden, Lawrence County, Arkansas, after Taylor (1936). B. Ventral view of head of same, approx. × ⅗, locality unknown, after Burt (1935). C. Lateral view of head of a prairie skink, *Eumeces septentrionalis*, × 1¾, K. U. no. 6988, 5 miles west of Onaga, Pottawatomie County, Kansas, after Taylor (1936). D. Ventral view of head of same species, locality unknown, after Smith (1946).

3′. Frontal nearly rectangular, with nearly straight sides, rear part being but little narrower than forepart; lower eyelid with many scales, none windowlike; supranasals present (Fig. 116).

4. Third scale row (counting to either side from the middle of the back) with a dorsolateral light line running down its middle (not yet known from Kansas) *Eumeces multivirgatus*, p. 321

4′. Third scale row not marked by any light line.

5. Only 7 or fewer rows of scales parallel with long axis of body; lateral rows oblique, rising as they continue posteriorly (Fig. 117A) . . . . *Eumeces obsoletus*, p. 197

5′. At least 8 dorsal scale rows, and usually also lateral rows, parallel with long axis of body (Fig. 117B).

6. One postmental (Fig. 118B); no postnasal (Fig. 118A); never a forked median light line on head. *Eumeces anthracinus*, p. 188

6′. Two postmentals (Fig. 118D); postnasal present or absent; median light line forking on head or not.

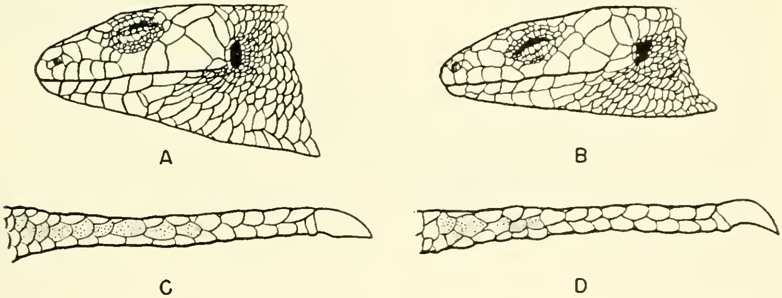


FIG. 119. A. Side view of head of *Eumeces laticeps*. B. Same, *E. fasciatus*. C. Posterior surface of right fourth toe of *E. laticeps*. D. Same, *E. fasciatus*. All from Smith (1946). A and B, × 1; C and D, × 3.

7. In young and subadults, a median light line present, forking on head; in adults, dorsolateral light line indistinct or bordered medially by a dark line narrower than the light line or by no dark line at all; postnasal present.

8. No postlabials, or 1 or 2 of small size; lateral intercalary scales on 4th toe reaching onto next to last phalanx; maximum snout-to-vent length 5$\frac{1}{16}$ inches . . . . *Eumeces laticeps*, p. 194

8′. Two postlabials of relatively large size; lateral intercalary scales on 4th toe not reaching penultimate phalanx; maximum snout-vent measurement 3$\frac{1}{8}$ inches . . . *Eumeces fasciatus*, p. 191

7′. Median light line never forking on head; dorsolateral light line always distinct and bordered medially by a dark line as broad as, or even broader than, the light line; postnasal absent (Fig. 118C) . . . . *Eumeces septentrionalis*, p. 200

FAMILY IGUANIDAE

Genus *Anolis* Daudin

Carolina Anole

Anolis carolinensis Voigt

Anolius carolinensis Voigt, Cuvier's Thierreich, vol. 2, 1832, p. 71 (type locality—Charleston, South Carolina).

Range.—Not a natural inhabitant of Kansas. Introduced in the vicinity of Leavenworth.

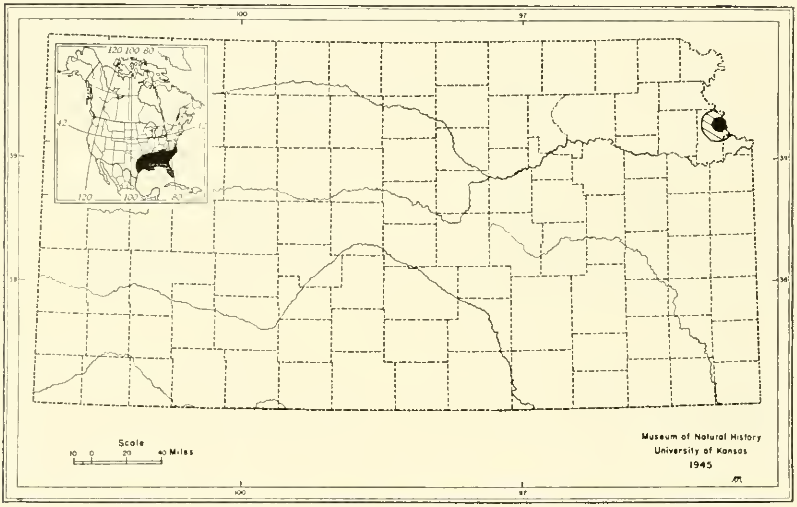


Fig. 120. Distribution of the Carolina anole, *Anolis carolinensis*, in Kansas, with insert showing range of the species.

Description.—The head is long, flattened, and rather wedge-shaped, covered above with small, heavily keeled scales. The dorsal scales are a little more strongly keeled; fingers and toes, except the first on each hand, curiously expanded near tips; expanded parts provided with numerous fine lamellae; last joint with claw, extending beyond expanded part. Male with a loose, integumentary fold in middle of throat, supported internally by a slender rod of cartilage. This supporting rod can be lifted away (downward) from the surface of the body by swinging it from its attached, anterior end; thus the loose skin is pulled away from the body and flared so as to show the bright color of the skin between the scales. There are no femoral pores, but enlarged postanal scales are present. The tail is round in cross section.

The color of lizards capable of such pronounced metachrosis as these is difficult to describe. The animals may be a uniform light brown above and flecked with brown below, or pure, pale green above and white below. Almost all imaginable intermediates between these two extremes can be assumed by the lizards at will. In some a middorsal light stripe may extend from the head to the tail. The back may be mottled with brown and green, or show short, irregular, dark stripes. This dark pattern varies greatly between specimens but is constant in any one animal in that phase of its color repertoire in which the pattern is evident at all. Dark specimens usually show several short, longitudinal dark streaks on the sides of the throat, fine white flecks on the sides of the body, and a dim reticulation or spotting with darker brown on the sides of the abdomen. Both green and brown specimens have a white or cream stripe along the sides of the head below the eye; in dark specimens it extends to the shoulders more or less through the middle of the eye. The dewlap in males is colored a brilliant red, but the color is fully visible only when the fan is spread. The females lack a well-developed dewlap but sometimes show feeble evidence of it in the middle of the throat.

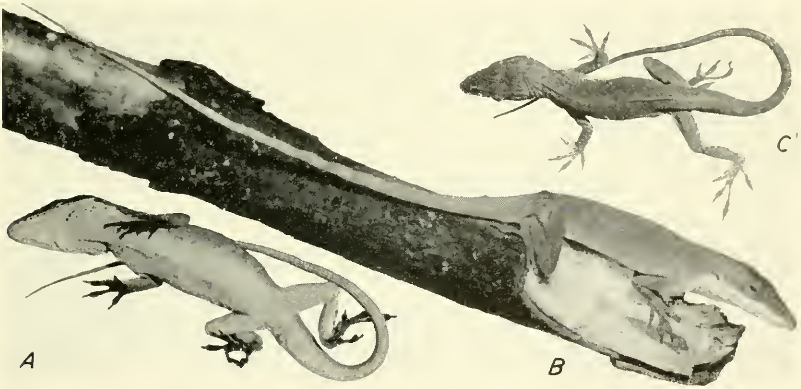


FIG. 121. Carolina anoles, *Anolis c. carolinensis*. A. Female, × 7/10, from Auburn, Alabama. B. Male, Thomson, Georgia. C. Male, × 1/2, from Auburn, Alabama. From Smith (1946). Photos by A. A. and A. H. Wright (A, C), and Gloyd (B).

Size small, the snout-vent length reaching 2¾ inches; the tail is long, approximately twice the snout-vent length.

Recognition Characters.—No other lizard in this state possesses expanded digits, or a well-developed dewlap in males, or the combination of the presence of tiny scales all over the body with the absence of a transverse gular fold.

Habits and Habitat.—These animals are found on trees, shrubs, vines, low vegetation, fences, and sometimes old wooden buildings. Shade, some sort of protection, and something on which they can climb limit their range of habitat. In relatively dry areas they choose moist habitats and are less abundant.

Like most other lizards of the United States, anoles are diurnal, beginning their movements when the temperature has risen in late morning. They are most active early in the day. They feed mostly upon flies and may function usefully in the control of mosquitoes.

Males frequently fight among themselves, spreading the throat fan as a threatening gesture. Also, probably to intimidate an adversary, the skin along the middle of the back and neck is elevated to form a high crest. They are known to climb fifty or sixty feet above the ground in trees; when active they make two-foot leaps between limbs. They swim well and may live in waterside bushes.

The skin is shed several times a year and is usually eaten. In captivity the animals are known to live nearly four years.

Mating occurs in April or May, and the eggs, usually two in number, are laid in June a few inches below the surface in loose, slightly moist debris. The eggs measure approximately 6 × 11 mm., are soft-shelled, and hatch in six to seven weeks.

Since the anole is the most common reptile "pet" or curio in the United States, some details of its proper care may be of interest. Although the lizards are normally short-lived, many die prematurely in captivity because of lack of attention.

In summer, anoles may have the run of a screened porch, but during the winter a cage should be provided. A box, preferably "at least two or three feet long, placed where it will receive plenty of sunlight, may be used. The open face should be covered with a pane of glass, mosquito netting, or a fine-meshed wire screening. A small, shallow bowl containing a water hyacinth . . . or some other water plant should be placed inside the cage and a little water sprayed over its leaves at least once each day, as these lizards normally procure what water they require by lapping up with their thick tongues scattered droplets on leaves. A captive anole may soon die of thirst even with a pan of water in the cage. *Do not give sweetened water. An anole will soon die on a diet of sugar and water.* . . .

"Captive chameleons may be fed on flies and meal worms or on insects caught in a net swept through rank vegetation. Under ordinary conditions, live meal worms will prove to be the most satisfactory diet, especially as they may be bred or purchased from dealers. Cockroaches have been found acceptable when other insects have been refused." (Wildlife Research and Management Leaflet BS-92.)

Kansan Subspecies.—*A. c. carolinensis* is the subspecies occurring in Kansas. Two others occur in the West Indies.

References.—Smith, 1946: 95-99, fig. 59, pl. 11, map 2 (description, natural history, range); Brumwell, 1942:54 (establishment in Kansas).

Genus *Holbrookia* Girard

Earless Lizard

Holbrookia maculata Girard

Holbrookia maculata Girard, Proc. Amer. Assoc. Adv. Sci., New Haven, vol. 4, 1851, p. 201 (type locality—opposite Grand Island, Platte River, Nebraska).

Range.—State-wide except in the eastern fourth. Peripheral localities on the eastern edge of the recorded range in Kansas are in Rawlins (4 miles northeast of Ludell), Osborne (Alton), Dickinson (Manchester), Lyon (6 miles southeast of Emporia), Woodson (Neosho Falls), Wilson, and Elk (Longton) counties.

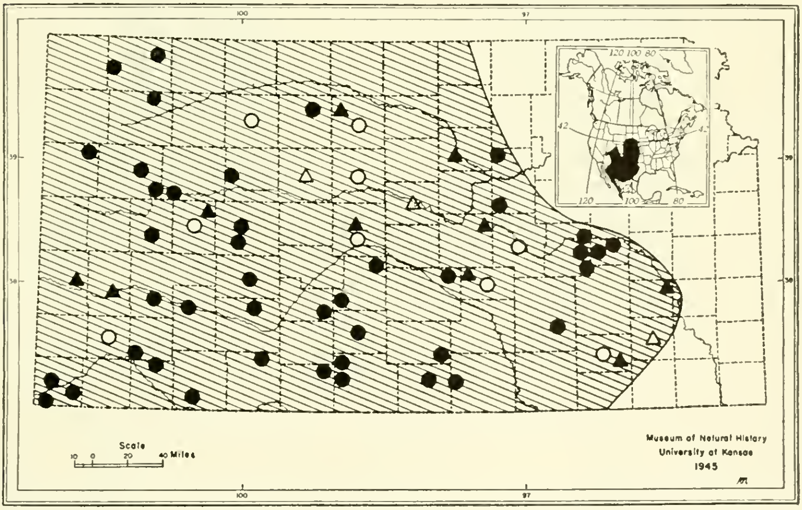


FIG. 122. Distribution of the earless lizard, *Holbrookia maculata*, in Kansas, with insert showing range of the species.

Description.—Dorsal scales small, flat; lateral scales a little smaller, decreasing in size toward belly, but somewhat pointed and elevated near tips; belly scales larger, smooth, flat, grading into lateral scales; a prominent, granular, gular fold, and a smaller, pregular one just anterior to it; supralabials diagonal; a triangular postmental; supraoculars numerous, slightly enlarged, separated from median head scales by one or two rows of small scales; femoral pores usually ten to fourteen; enlarged postanals present in males.

Dorsal ground color light gray to gray-brown; a broad, middorsal, gray, unmarked light area; on either side of this is a series of nine to fourteen dark brown spots on body; dark spots a little broader than long, bordered laterally by a rather dim, dorsolateral light line extending from orbit to base of tail; another light line extending from axilla to groin; area between these light lines on either side unmarked or with a series of dim spots similar to those on back. Two black, diagonal bars, directed posteroventrally, extending from extreme lateral belly scales and disappearing a short distance above lateral fold; these bars, and sometimes 1 or 2 similar bars posterior

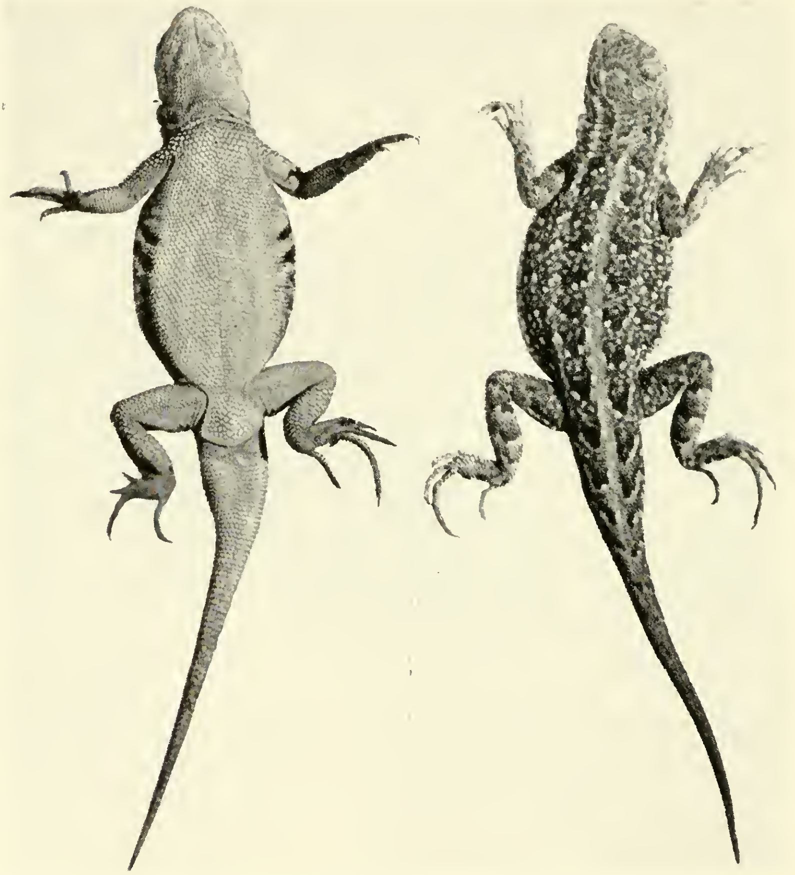


FIG. 123. An earless lizard, *Holbrookia m. maculata*, × 1, from 3 miles east of Sharon Springs, Kansas. Dorsal and ventral views of a male, from Smith (1946). Photos by A. A. and A. H. Wright.

to these, are always present in males and usually in females; in the latter the belly is otherwise unmarked, except for a gray suffusion sometimes in the gular region; in males the throat is usually grayish, and frequently there is some mottling or a barred pattern laterally.

Size small, the snout-vent measurement reaching 2 7/16 inches. The tail is slightly shorter to slightly longer than the snout-vent length.

Recognition Characters.—No other lizard in the state lacks an ear opening or visible tympanum. The diagonal supralabials and triangular postmental are also distinctive. The only species frequently confused with it is *Sceloporus undulatus,* which can however be distinguished easily by the absence of a ventral throat fold, presence of an ear opening, flat supralabials not overlying each other, and by the absence of a median postmental.

Habits and Habitat.—A more or less sandy soil, where vegetation is sparse and low and where there is little grass, seems to be preferred by this species.

These lizards are not extremely wary, but are not often caught by hand. On warm days they are active and can be seen scampering about the bases of bushes. In the day they spend some time partly buried in the sand. Early in the evening, long before the sun actually sets, they retire to burrows made by mammals or other animals where they spend the nights and cold days. They are seldom found under rocks or other objects.

They eat spiders and insects. Grasshoppers comprise nearly a half, and true bugs about one-fourth of their food. As an eater of chinch bugs which damage planted crops, these lizards may be of considerable economic importance.

The breeding habits are little known. Mating occurs in late June and early July. The eggs number six to eight, and are probably laid in August. In the mating periods, this species is found in pairs composed of one individual of each sex. They are intensely curious which on occasion leads to their capture by enemies.

If kept in a sandy habitat and provided with adequate light and heat, these lizards live well in captivity, for they eat readily under proper conditions. Adequate but not excessive light and heat are best provided by a thermostatically controlled, weak light bulb.

Kansan Subspecies.—*H. m. maculata* Girard is the only subspecies in the state. Four other subspecies are recognized from the southwestern United States and northwestern Mexico.

References.—Burt, 1928: 53-54 (food); Burt, 1928: 11-16, map 2 (description, habits, habitat, Kansas records); Smith, 1946: 115-119, fig. 63, pl. 16, map 4 (distribution, description, habits, habitat).

Genus *Crotaphytus* Holbrook

Collared Lizard

Crotaphytus collaris (Say)

Agama collaris Say, Long's Exp. Rocky Mts., vol. 2, 1823, p. 252 (type locality—Verdigris River near its union with Arkansas River, Oklahoma).
Crotaphytus collaris Holbrook, N. Amer. Herp., ed. 2, vol. 2, 1842, p. 79, pl. 10.

Range.—Southern and central Kansas. Peripheral localities on the northern edge of the recorded range in Kansas are in Bourbon, Anderson (6 miles south of Garnett), Coffey (8 miles southeast of Waverly), Wabaunsee (2 miles northeast of Alma), Pottawatomie (east of Rocky Ford Power Plant), Riley (Garrison), Marshall (5 miles south of Waterville), Cloud (Miltonvale), Mitchell (Glen Elder), Lincoln (3 miles west of Sylvan Grove), Russell, Ellis, Rush (3 miles west of Shaffer) and Seward counties.

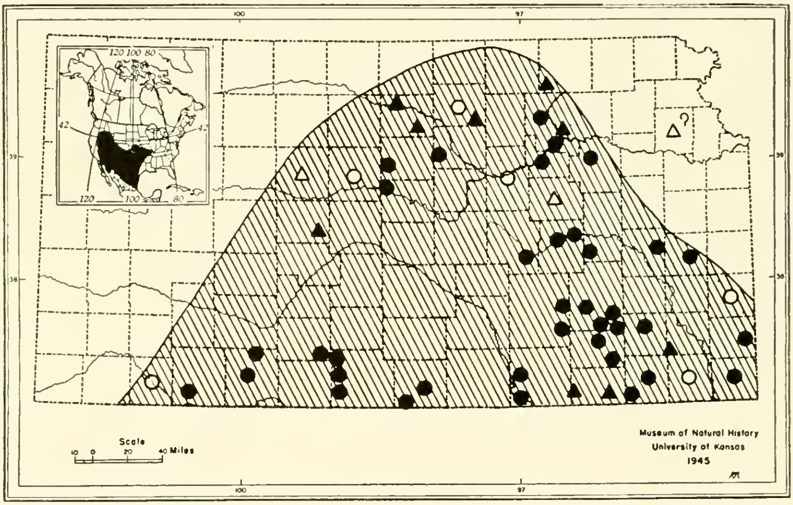


FIG. 124. Distribution of the collared lizard, *Crotaphytus collaris*, in Kansas, with insert showing range of the species.

Description.—Head broad and distinctly set off from body by a relatively narrow neck; scales on head small; 1, 2, 3 or 4 unpaired, rather irregular, scales between areas above eyes; a distinct fold across throat; ear opening large, oval, not protected by overlapping scales; dorsal scales small, smooth; ventral scales a little larger; a long series of 14 to 27 femoral pores on each thigh; males lacking enlarged postanal scales.

Males of this species are brightly colored; ground color straw yellow; a black collar, broken in the middle, extends dorsally around the neck between the insertions of the arms; another collar preceding this, also broken medially; six dark crossbands on back; blue spots scattered near edges of dark bands; ventral surface white or cream, unmarked save for a coarse reticulation on lower lips; throat sometimes orange or yellow. Females marked like males but less brightly colored. Young with broader collars on neck and more distinct dark bands on body; these bands may enclose large, more or less circular, light marks; the breaking up of these circular marks in adults results in small blue flecks near edges of crossbands; in very old specimens crossbands disappear completely and the only distinct markings remaining may be light flecks.

Size large, snout-vent length reaching 115 mm.; tail usually about twice as long as body and head. Males have a notably broader, more muscular head, than females. Hind legs larger than the forelegs, and about as long as head and body.

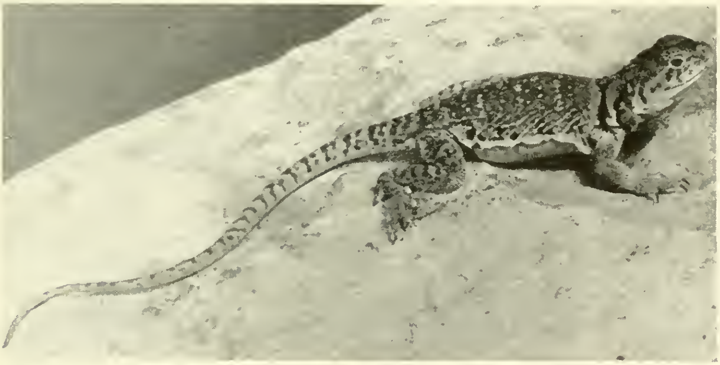


FIG. 125. A collared lizard, *Crotaphytus c. collaris*, × ½, Manhattan, Kansas, from Smith (1946). Courtesy Howard K. Gloyd.

Recognition Characters.—The general body form of this species is distinctive. No single scale character is distinctive, but the combination of a transverse gular fold, absence of horns on the head, presence of an ear opening, and small ventral scales less than six times as large as the dorsals, will serve to identify all specimens of the species.

Habits and Habitat.—These lizards are common on the limestone-capped hills of the central part of the state, where they reach their maximum abundance. They are restricted to rocky areas or canyons in the prairies, and thus do not occur on the vast expanse of flat prairie in the west.

The pugnacious habits of these lizards are well known. Their discrimination must be poor, for they sometimes react threateningly at almost any movement, when startled, whether the moving object be a dog, human, or train. Sometimes they are taken by surprise, but usually they see an intruder when he is yet a considerable distance away and take refuge under stones or in cracks before the intruder arrives on the scene.

The eggs vary from four to twenty-four according to published accounts, and may be deposited in loose sand to a depth of four or five inches, or in tunnels underneath rocks.

The food consists largely of grasshoppers, but includes other large arthropods such as spiders, beetles, moths, and occasionally small vertebrates, including other lizards.

Kansan Subspecies.—Only *C. c. collaris* Say occurs in Kansas. Two other subspecies, *C. c. baileyi* Stejneger and *C. c. auriceps* Fitch and Tanner occur in the southwestern United States.

References.—Burt, 1928: 51-53 (food); Burt, 1928: 5-11, fig. 1 (description, habits, habitat, Kansas distribution); Smith, 1946: 168-170, fig. 71, pl. 32, map 8 (description, range, habits).

Genus *Sceloporus* Wiegmann

Rough-scaled Lizard

Sceloporus undulatus (Latreille)

Stellio undulatus Latreille, Hist. Nat. Rept., vol. 2, 1802, p. 40 (type locality—Charleston, South Carolina).
Sceloporus undulatus Wiegmann, Isis, 1828, p. 369.

Range.—State-wide, except for a peculiar gap that occupies most of the eastern third of the state. Peripheral localities on the eastern edge of the recorded range of the western subspecies, *S. u. garmani*, are in Norton (2 miles southeast of Dinsmore), Rooks (Stockton), Osborne, Saline (Brookville), Geary (Fort Riley), Douglas (Lawrence), Chase, Harvey (10 miles northwest of Halstead), Sedgwick (Clearwater), and Cowley (Arkansas City) counties. The eastward record stations, in Geary and Douglas counties, probably result from floodwaters carrying animals eastward of their normal geographic range. The eastern subspecies, *S. u. hyacinthinus*, is known from only as far west as Cherokee (1 mile north of Crestline), Crawford (3 miles north of Pittsburg), Johnson (3 miles west of Mission), Wyandotte and Atchison (Atchison) counties; these are the only counties from which reliable records are now available.

120 100 80
40
120
100

Description.—Dorsal scales rough, overlapping, with backward-projecting spines thirty-five to forty-nine from occiput to base of tail; ventral scales a little smaller than dorsal scales; numerous scales on top of head, irregular in shape and number; no transverse fold across throat; femoral pores ten to nineteen on each side.

In the eastern subspecies, *S. u. hyacinthinus*, ground color gray-brown, broken by a series of six to ten narrow, dark, undulating crossbands; ventral surface, in males, bluish at sides of belly, bluish color being bordered by black; middle of belly light, or in large specimens black; throat suffused with gray, becoming black in large specimens. Ventral surface in females and young dusky, with small, scattered dark marks and no distinct large markings.

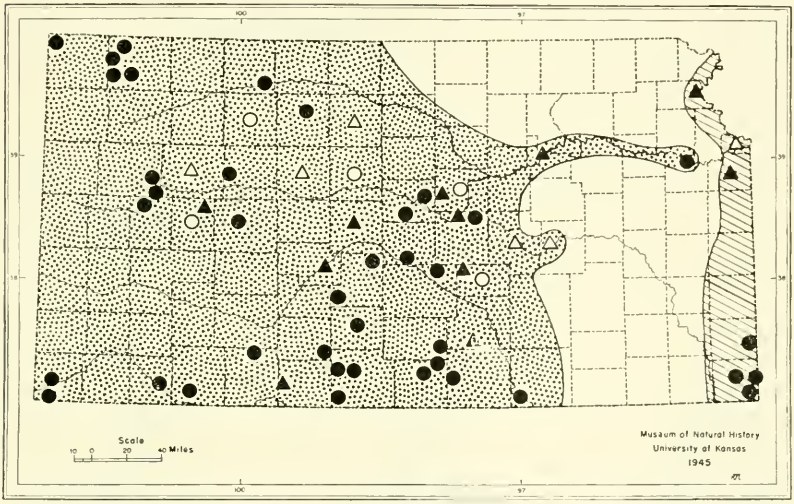


FIG. 126. Distribution of the rough-scaled lizard, *Sceloporus undulatus*, in Kansas. The range of *S. u. hyacinthinus* in the eastern part of the state is indicated by the lined area, that of *S. u. garmani* by the stippled area.

In the western subspecies, *S. u. garmani*, ground color light brown; a dorsolateral light stripe, and sometimes a lateral one also; on each side of mid-dorsal line a series of nine small, dark brown spots. In males, sides of belly light blue, from axilla to groin, but ventral surfaces otherwise white. Females not marked below.

Size moderate, snout-vent length reaching 2⅛ inches; tail about 1½ times as long as rest of animal.

Recognition Characters.—The distinctive feature of this lizard, within the boundaries of the state of Kansas, is the presence of uniform, overlapping, relatively large dorsal scales with sharp points on their posterior edges. Another feature of importance is the absence of a transverse or longitudinal fold on the throat. The latter character alone, in fact, distinguishes this species from all others with the exception of the legless lizard, the horned lizards, and the smooth-scaled skinks; all of these are readily separated from *Sceloporus* by other characters.

Habits and Habitat.—The habitat of *S. u. hyacinthinus*, the eastern race, is dry forested areas, where the animals may frequent almost any sort of object on which they can climb if it receives a fair amount of sunshine. They spend a great deal of time basking in the sun, and for that reason heavy woods through which the sun does not penetrate are uninhabited. They frequently spend as much as half of their time in the day on the ground, but trees or other objects on which they can climb are a necessary part of their habitat.

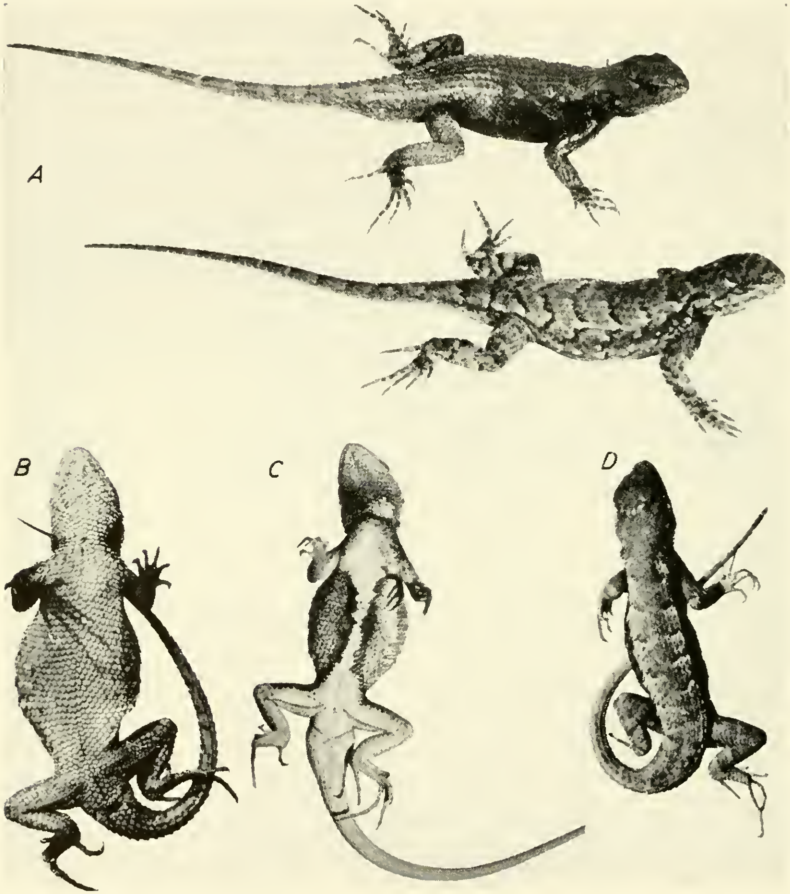


Fig. 127. Rough-scaled lizards, *Sceloporus undulatus hyacinthinus*, all × ½. A. Patuxent Research Refuge, Bowie, Maryland; female and male. B. Weymouth, New Jersey; female. C. Same locality; male. D. San Antonio, Texas; male. From Smith (1946). Photos by A. A. and A. H. Wright (B-D), and by U. S. Fish and Wildlife Service (A).

In Missouri, hibernation may begin as late as November 15, and emergence may follow as early as February 10. As in most species of lizards, the adults spend a longer time in hibernation than do the young, and for both age groups the actual length of hibernation varies greatly according to the rigor of the season. Hibernating quarters are burrows in the ground, spaces under or between rocks, or within rotten logs or stumps.

Soon after emergence from hibernation the breeding season commences, and lasts several weeks. In this time the lizards are active and react quickly to the presence of others of their species. They occupy rather restricted territories, and males will defend their territories from the entry of others. Females do not defend territory and are permitted by the males to wander freely. Apparently, for a period of some two or three weeks, during the mating season, there is a sort of family tie.

The eggs are laid, about eight weeks after mating, one-half to four inches below the surface of slightly damp soil. The lizard makes its own burrow for the eggs, lays four to seventeen eggs, and then covers them carefully. Egg-laying may occur over a period of six weeks, in any one year, and the eggs hatch in about ten weeks.

The lizards have a voracious appetite, and eat all kinds of small or medium-sized terrestrial arthropods. Ordinarily only moving prey is taken. Most of the food is taken early in the morning, after a brief period of sunning. During hot parts of the day the lizards are quiescent, and in the evening they may again become active just before retiring at dusk.

When pursued, they seek to conceal themselves rather than to escape by rapid flight. The immediate reaction is to climb something, and enter a hole, hide under a loose bit of bark, or just to keep the structure on which the animal is climbing between it and the source of danger.

At night it appears that the lizards sleep aloft rather than on the ground.

The western subspecies, S. *u. garmani*, prefers a terrestrial habitat and in fact seldom climbs except upon rocks and sometimes in weeds. Sand dunes or sandy soil seems to be preferred, and in such habitats these lizards may be nearly as abundant as the earless lizards. They are more widely distributed than the latter, being found on sandstone hills, in the white chalk cliffs of the western part of the state, and even on the open prairie wherever there is some cover such as piles of weeds, or burrows of mammals. They are frequently found under shocks of wheat.

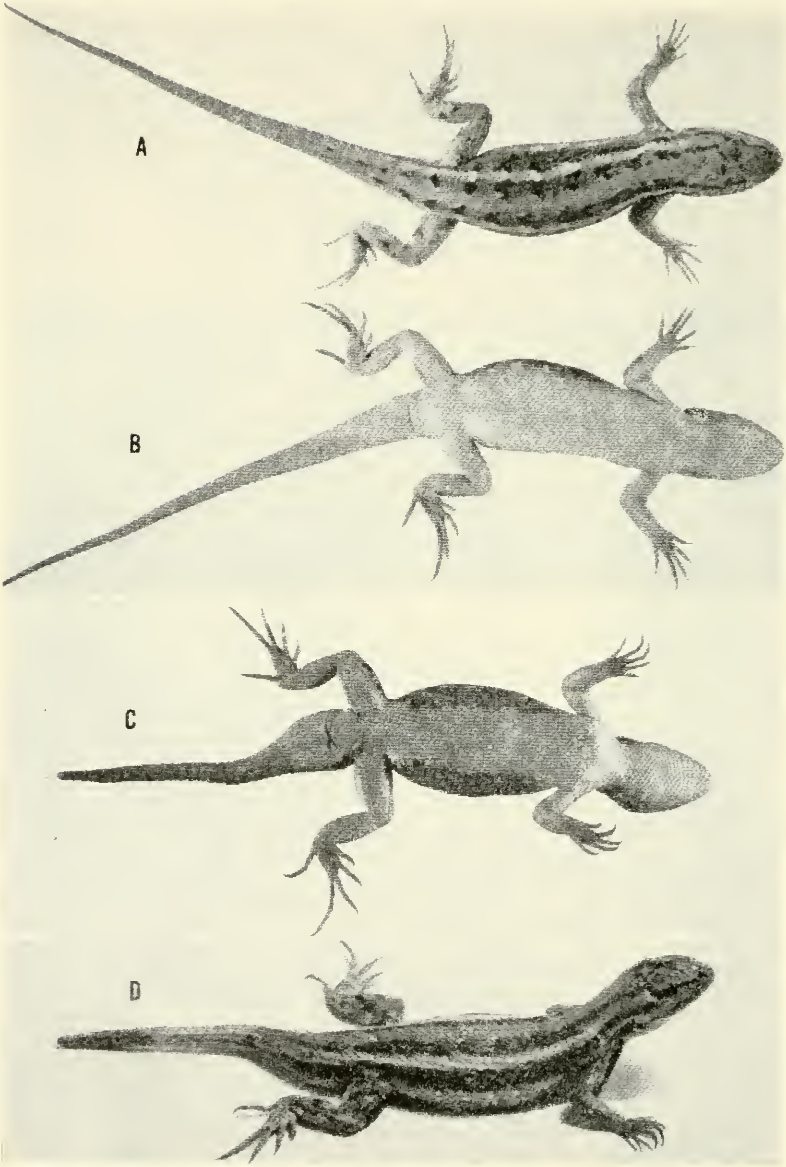


FIG. 128. Rough-scaled lizards, *Sceloporus undulatus garmani,* all × ⅘. A, B, female, from 10 miles southwest of Winfield, Kansas. C, D, male, from Hackberry Lake, Gordon County, Nebraska. From Smith (1946). Photos by U. S. Fish and Wildlife Service.

The food consists of small grasshoppers and beetles, for the most part. Large insects may be killed but not eaten. Ladybird beetles and bees are not molested. A bee sting will kill one of these lizards.

Seven to eleven eggs are laid in the middle of June.

Kansan Subspecies.—Two occur in the state: *Sceloporus undulatus garmani* Boulenger (type locality at Pine Ridge, South Dakota), and *Sceloporus undulatus hyacinthinus* (Green) (type locality at Princeton, New Jersey). Five other subspecies are recognized from areas outside the state. The situation with regard to the two subspecies in Kansas is rather strange, for their ranges do not meet, so far as is now known, within the state, where the two forms are entirely distinct. They do meet farther south, in Oklahoma and Texas, however, and intergradation occurs there. They can be identified by the following differences.

hyacinthinus	*garmani*
1. Dark markings on back narrow but extending transversely across most of back, usually crossing the dorsolateral light lines.	1. Dark markings on back not more than 3 times as wide as long, not crossing either a broad middorsal zone or a distinct dorsolateral light line.
2. Males with 1 or 2 large, distinct, dark blue or black areas on throat.	2. Throat of males unmarked or with two very inconspicuous dark markings posteriorly.
3. Scales in a line between ends of femoral pore series, by smallest count, 7 or more in 75 percent of 286 counts.	3. Scales in a line between ends of femoral pore series, by smallest count, 7 or more in 6 percent of 47 counts.

References.—Burt, 1928: 54-56 (food); Burt, 1928: 16-27, figs. 3, 4 (Kansas distribution, habits, habitat, description); Smith, 1938: 8-10, 14-15 (taxonomy); Smith, 1946: 222-231, pls. 51, 52, map 15 (range, description, habits, habitat).

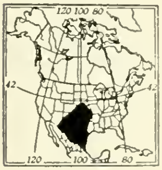
Genus *Phrynosoma* Wiegmann

Texan Horned Lizard

Phrynosoma cornutum (Harlan)

Agama cornuta Harlan, Journ. Acad. Nat. Sci. Phila., vol. 4, 1825, p. 299, pl. 20 (type locality—Fort Riley, Geary County, Kansas).

Phrynosoma cornutum Gray, Griffith's Cuvier's Anim. Kingdom, Syn. Rept., 1831, p. 9.



Range.—Almost state-wide, excluding only the northwestern and northeastern corners. To the west the species has been recorded as far as Rawlins County, but other records would limit it at a line from Morton (12 miles northwest of Elkhart) through Ellis to Phillips (4 miles south of Glade) counties. Toward the northeast it has been recorded as far as Smith, Cloud (7 miles southeast of Scottsville), Ottawa, Riley (Manhattan), Douglas (Lawrence), Franklin (Ottawa), and Bourbon (Fort Scott) counties. Some peripheral occurrences may be introductions.

Description.—A much enlarged spine on each side of the back of the head; three other spines, about half as large or less, projecting from the rear sides of the head; a series of large chinshields, greatly increasing in size posteriorly, separated by a couple of rows of small scales from the lower labials; three groups of lateral neck spines; a transverse gular fold; dorsal scales mostly small, but scattered, enlarged, keeled spines also present; numerous keeled scales near middorsal line, but latter with only small scales; two series of spines at fringe of abdomen, and one series along sides of tail; femoral pores and enlarged postanals poorly defined.

Ground color light yellowish brown to reddish brown or tan; a dark brown; elongate, white-edged, sharply outlined blotch on each side immediately behind head; a series of four more or less rounded dark spots on either side of middorsal line on body, each bordered posteriorly by a white streak, and each surrounding an enlarged spine; another series of three similar spots on either side, frequently fused with the more median row to form transverse, undulate bars; a light middorsal streak from head to tail; a number of alternating dark and light streaks across top of head, and radiating from eye; ventral surfaces white, unspotted or with a few small, rounded dark spots on chest, belly and preanal region.

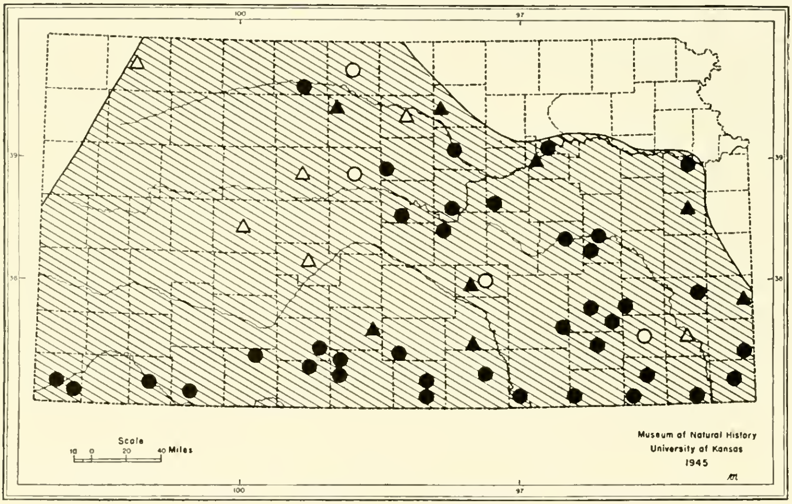


FIG. 129. Distribution of the Texan horned lizard, *Phrynosoma cornutum*, in Kansas.

Size moderate, snout-vent length reaching 4¼ inches, about 2½ times length of tail.

Recognition Characters.—The presence of a pair of large spines at the rear of the head, three times as large as the spines just back of eye, is distinctive of this species of horned lizard in Kansas. In the other species of *Phrynosoma* the occipital horns are much smaller (less than half the size of the postocular horns), and the chinshields decrease instead of increase in size posteriorly.

Habits and Habitat.—These are terrestrial lizards which occur on almost any type of flat, dry land where vegetation is scanty. The soil may be rocky, sandy or a loam.

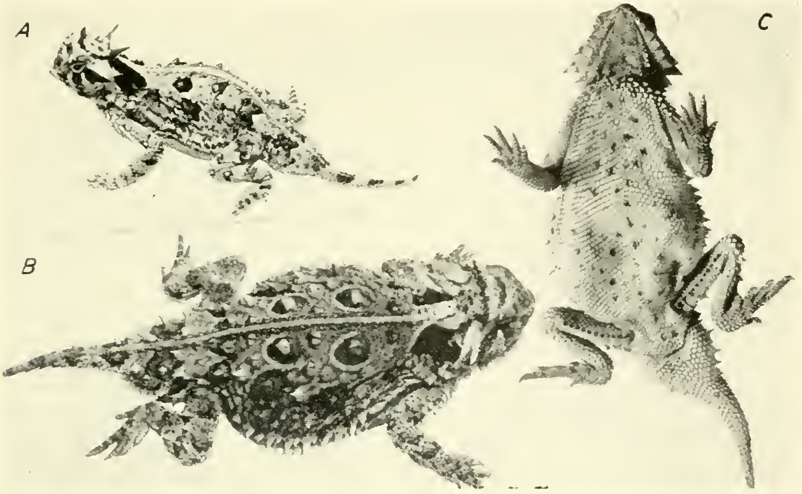


FIG. 130. Texan horned lizards, *Phrynosoma cornutum*. A, × ⅖, and C, × ⅔, both from 10 miles southeast of Comstock, Texas; male. B, × ⅔, from Wilcox, Arizona. From Smith (1946). Photos by A. A. and A. H. Wright.

Exclusively diurnal, these lizards prey upon many types of arthropods, which are active in the daytime. Ants form by far the largest part of the diet. As befits a lizard which requires such high temperatures for feeding, hibernation occurs early—in September or October; emergence follows in April or May. Mating occurs soon after emergence, and some time later a large number (23 to 37) of eggs are laid in pits dug to a depth of five to seven inches in loose soil or sand. The eggs hatch in thirty-nine to forty-seven days.

Immediately after being captured, rare individuals have been observed to squirt a tiny stream, or a few drops, of blood from one or both eyes to a distance of several feet.

Kansan Subspecies.—No subspecies have been defined anywhere in the range of this species.

References.—Burt, 1928: 56-58 (food); Burt, 1928: 27-32, fig. 5 (description, habits, habitat, Kansas localities); Smith, 1946: 290-293, fig. 84, pl. 74, map 20 (description, habits, habitat, distribution).

Short-horned Lizard

Phrynosoma douglassii (Bell)

Agama douglassii Bell, Trans. Linn. Soc. London, vol. 16, 1833, p. 105, pl. 10 (type locality—watershed of Columbia River).
Phrynosoma douglassii Wagler, Syst. Amph., 1830, p. 146.

Range.—Perhaps northwestern third of state; recorded only from Smith, Rooks, Logan, Ellis (Hays) and Edwards counties, but the verified distribution of this species in states adjoining Kansas, and the lack of preciseness and authenticity of each record for Kansas, strongly suggest that all records for Kansas are based either upon escaped specimens imported from elsewhere, or upon erroneous data.

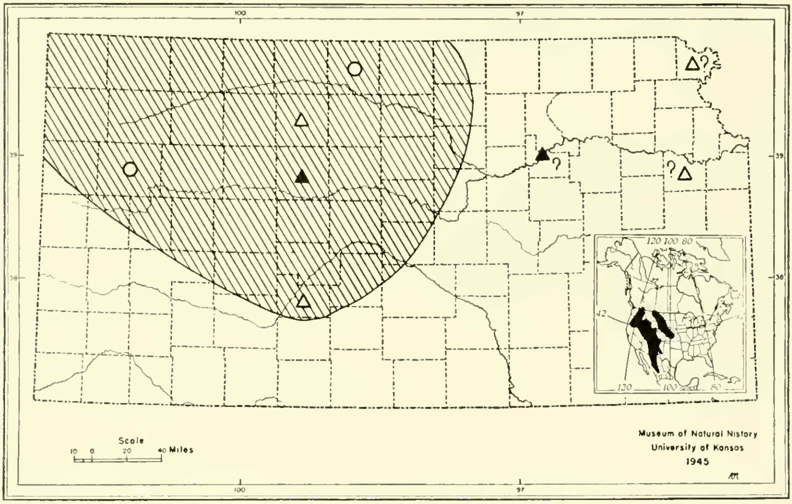


Fig. 131. Distribution of the short-horned lizards, *Phrynosoma douglassii*, in Kansas, with insert showing range of the species.

Description.—Horns on head short, the pair at rear on either side of middorsal line not over twice size of other horns; three or four small horns at either side of rear of head, and another back of each eye; chinshields decreasing in size posteriorly; a pair or more of transverse folds on throat; several enlarged scales on a loose fold on either side of neck; dorsal scales highly irregular in size; four series of enlarged scales toward tip of tail; a single fringe of elongate scales at sides of abdomen; belly scales small, smooth; femoral pores twelve to sixteen.

Ground color gray or brown; a series of three or four irregularly outlined, dark blotches on each side of middorsal line, and sometimes a similar lateral series; each blotch light-edged posteriorly, fading into ground color anteriorly; a large, indistinct blotch on each side of neck behind head; lateral fringe of scales whitish; belly light, sometimes black-speckled; throat usually mottled with gray.

Size relatively small, snout-vent measurement reaching 2½ inches; tail a little less to a little more than half length of rest of animal.

Recognition Characters.—The presence of horns on the head, none of which are conspicuously enlarged (for instance to the length of the eye), is distinctive. See discussion of *Phrynosoma cornutum.*

Habits and Habitat.—In Nebraska these lizards are said to occur in fairly rough terrain in the semiarid short-grass plains.

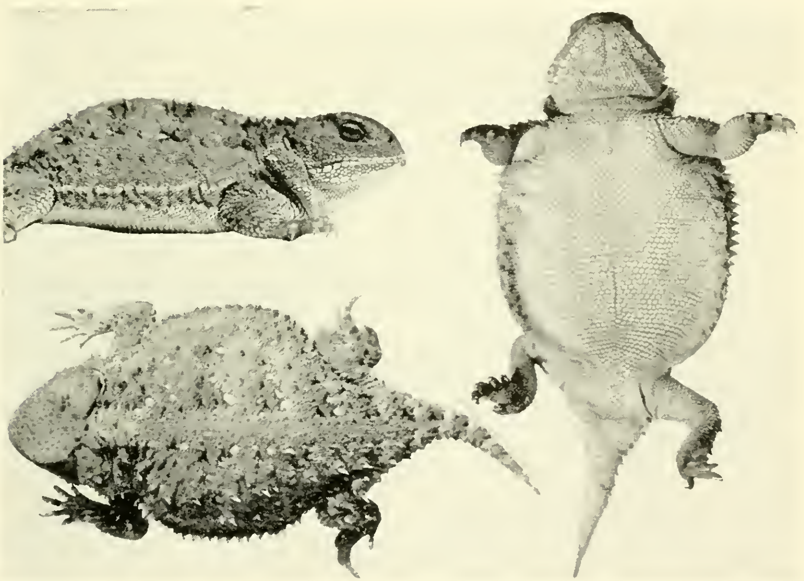


FIG. 132. A short-horned lizard, *Phrynosoma douglassii brevirostre*, × ¾, Casper, Wyoming; female. From Smith (1946). Photos by A. A. and A. H. Wright.

The food consists mostly of grasshoppers and ants.

This species gives birth to young instead of laying eggs. Broods from females of the subspecies occurring in Kansas contain five or six young. Possibly several broods are carried at once, as one female contained six young about ready to be born, and four large eggs.

In Kansas this is the rarest of native lizards. Any specimens discovered are well worth preservation in a museum (see pp. 18, 25).

Kansan Subspecies.—Only *Phrynosoma douglassii brevirostre* (Girard), with type locality at Pole Creek, Nebraska, is ascribed to Kansas and this ascription is open to question; see above (page 184) under "*Range.*" Four other subspecies are currently recognized in the western United States.

References.—Burt, 1928: 32-36, map fig. 6 (description, Kansas localities); Smith, 1946: 302-304, pl. 79, map 21 (description, natural history, distribution).

FAMILY SCINCIDAE

Genus *Scincella* Mittleman

Brown Skink

Scincella laterale (Say)

Scincus lateralis Say, Long's Exp. Rocky Mts., vol. 2, 1823, p. 324 (type locality—Banks of Mississippi below Cape Girardeau, Missouri).
Scincella laterale Mittleman, Herpetologica, vol. 6, 1950, p. 19.

Range.—Eastern third of state. Peripheral localities on the western edge of the recorded range in Kansas are in Harper (7 miles southwest of Norwich), Kingman (2 miles north of Adams), Clay (Clay Center), Pottawatomie (Flush), Jefferson (10 miles north of Lawrence) and Leavenworth (7 miles northeast of Lawrence) counties.

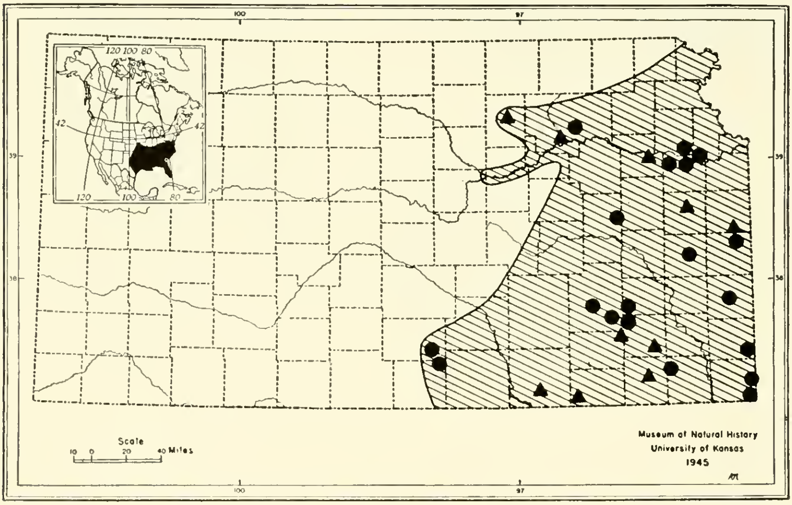


FIG. 133. Distribution of the brown skink, *Scincella laterale*, in Kansas, with insert showing range of the species.

Description.—All scales of body small, very smooth, flat, and rounded; twenty-six to thirty-two (usually 28 or 30) scale rows around middle of body, and seventy-seven to eighty scales from parietal to above anus; head scales large, regular, including among the more important a large frontonasal broadly in contact with rostral; no supranasals; a large elongate frontal in contact anteriorly with frontonasal, narrowly in contact with two frontoparietals posteriorly; a large parietal on each side, narrowly in contact behind a small, median interparietal; four large supraoculars, second largest; seven upper labials, fourth smallest; a nearly transparent window in lower eyelid; median row of subcaudals somewhat enlarged.

Light brown above, the sides dark brown, and sometimes a fine white line at point of contact of the two colors; sides light below the lateral dark stripe, which occupies two scale rows and sometimes half of each adjacent row; lower lips and sometimes throat with irregular dark gray marks or bars.

Size small, snout-vent length reaching 1⅞ inches; tail 1½ times as long as body.

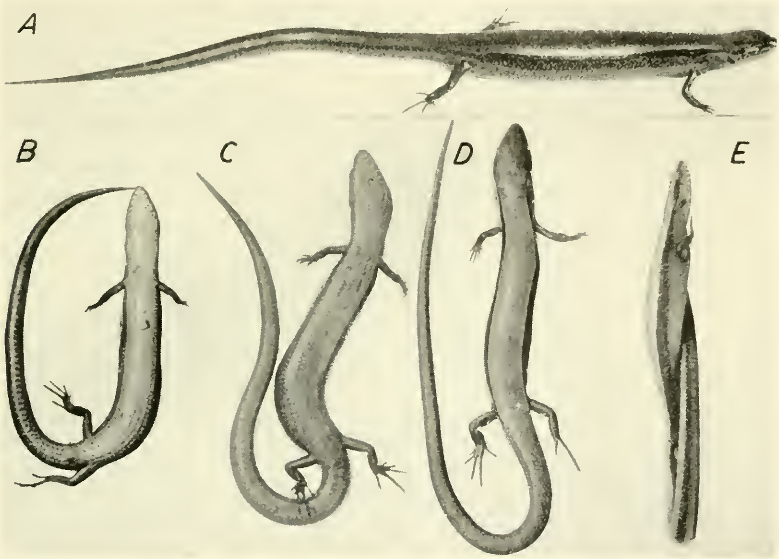


FIG. 134. Brown skinks, *Scincella laterale,* × $^9/_{10}$. A. Patuxent Research Refuge, Bowie, Maryland. B, D, E, Somerset, Texas. C. Helotes, Texas. From Smith (1946). Photos by A. A. and A. H. Wright (B-E), and by U. S. Fish and Wildlife Service.

Recognition Characters.—All of the skinks are distinctive in having absolutely smooth, shiny scales—not granular or rough scales as in other legged-lizards of Kansas. The brown skink may be told from other species most easily by the shape of the frontal, which tapers sharply toward the posterior, instead of being about as broad in front as behind, as in other species. Also distinctive is the rather large, windowlike scale in the lower eyelid; in other skinks this is not present or is represented by several instead of a single scale. Furthermore, in no other skinks are the supranasals absent.

Habits and Habitat.—These skinks are found in wooded areas on the ground among leaves and other debris; moist places, frequently near streams, are preferred. Less commonly they are found in open fields or on grassy hills, under stones and logs.

These lizards are secretive, and seldom seen in the open. They are probably diurnal, but ordinarily they are seen during the day only when uncovered or startled from underneath objects of concealment. The food consists of small insects, millipeds, pillbugs, and earthworms.

The eggs, one to five in number (usually 3), are laid in humus, rotten stumps or logs. They measure about 9 × 4 mm., are thin and brittle-shelled. They are laid from early June to August. Hatching occurs in August and throughout September. The lizards are active from April through October.

Kansan Subspecies.—No subspecies have been defined anywhere in the range of this species.

References.—Burt, 1928: 61 (food); Burt, 1928: 45-49, map fig. 8 (description, natural history, Kansas localities); Smith, 1946: 337-340, figs. 94, 96, 98, pl. 92, map 25 (description, natural history, distribution); Johnson, 1953: 11-27 (life history); Slater, 1949: 79-80 (food habits).

Genus *Eumeces* Wiegmann

Coal Skink

Eumeces anthracinus (Baird)

Plestiodon anthracinus Baird, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 1, 1849, p. 294 (type locality—North Mountain near Carlisle, Pennsylvania).
Eumeces anthracinus Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 45.

Range.—Southeastern fifth of state; recorded from Dickinson (Carlton), Franklin (Homewood; Ottawa), Anderson (Glenlock), Miami (Pigeon Lake) and Cherokee (3 miles east of Crestline; 4 miles northeast of Baxter Springs) counties.

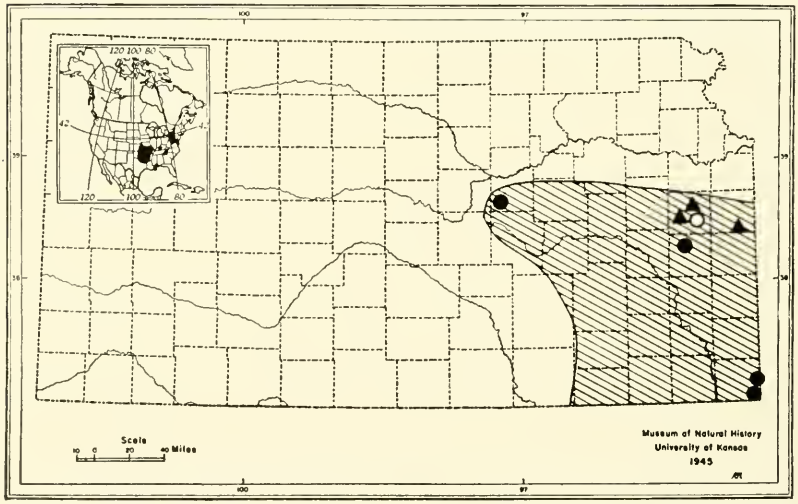


FIG. 135. Distribution of the coal skink, *Eumeces anthracinus*, in Kansas, with insert showing range of the species.

Description.—Scales around body uniform in size, flat, smooth, twenty-four to twenty-eight at middle of body; head scales rather large, regular, including among other scales of importance a single postmental, a scale longer than wide bordering postgenial medially; postnasals absent; seven supralabials; median subcaudals widened.

Adults olive gray to olive brown above; a narrow dorsolateral white line on each side, on scale rows three and four (counting from middorsum), originating at eye and extending onto tail; a broad, dark brown band below this, occupying two and one-half scale rows, and bordered below by a narrow white line; this light stripe is bordered below by a dark area fading gradually into the lighter ventral color; venter bluish or gray, unmarked; sometimes a narrow median light stripe, bordered on either side by black, on back, but not reaching onto head; a number of light spots on head. Young almost uniformly black, with reddish spots on head; tail deep blue-violet.

Size moderate, the snout-vent length reaching two and one-half inches. Tail about twice the length of the rest of the animal, in adults, about equal in the young; limbs overlapping when adpressed.

Recognition Characters.—All skinks can easily be recognized by the presence of uniform, smooth, overlapping scales all around the body; in all other legged-lizards of Kansas the scales are rough, different above and below, or are granular. The shape of the frontal, which is about as broad behind as in front, is distinctive of *Eumeces;* the absence of a single windowlike scale in the lower eyelid is also distinctive (*Eumeces* has several plates in the place of the window); and the presence of supranasals likewise will distinguish this genus from *Scincella,* the only other genus of skinks in the state. Within the genus *Eumeces,* as represented in Kansas, the species *E. anthracinus* is distinctive in being the only one with a single postmental, but this character is not infallible for it varies somewhat not only in this but in other species. From *E. obsoletus, anthracinus* differs in having the scale rows on the sides of the body parallel to those on the back; the absence of a middorsal light line forking on the head distinguishes it from all others except adult specimens of *E. fasciatus;* and the latter species can be distinguished by the presence of a postnasal.

Habits and Habitat.—Typically this skink is found on wooded hillsides in rotten logs, piles of debris, and under loose stones, in moist areas fairly near water. Usually these lizards are discovered in places of concealment, but they have been seen moving about enough in the daytime to indicate that they are diurnal. In seeking to escape they do not hesitate to take to water. Courtship and mating probably occur in April. Eight or nine eggs are laid in a nest guarded by the female. They hatch in four to five weeks, and the newly born young measure 47 to 51 mm. in total length. The food consists of insects and insect larvae.

It is impossible to predict with accuracy where specimens may be found, for many apparently suitable localities are uninhabited.

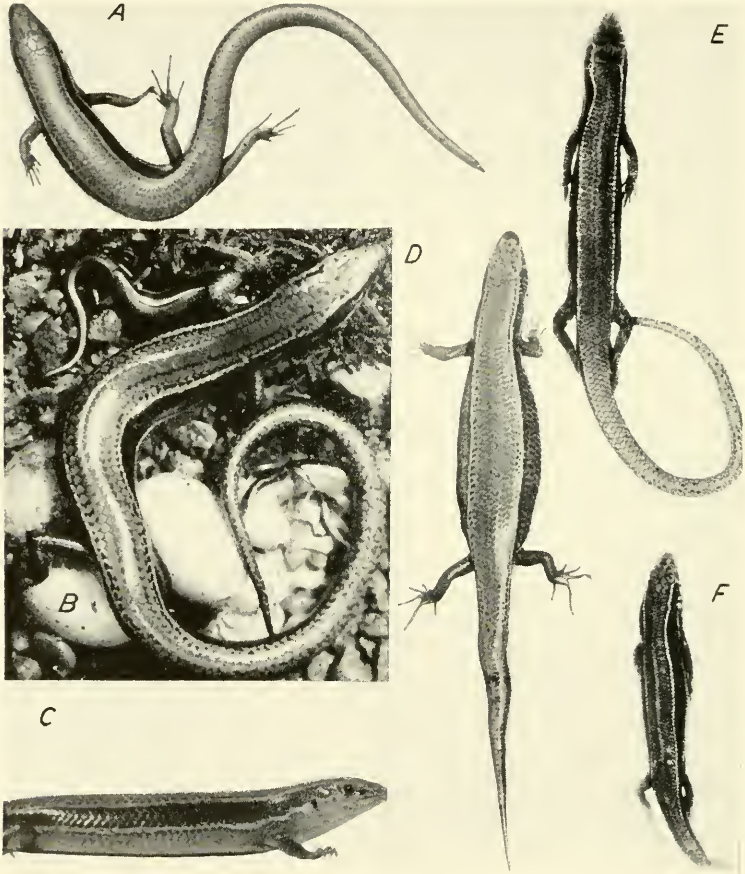


FIG. 136. Coal skink, *Eumeces anthracinus;* B, C, *E. a. anthracinus;* others, *E. a. pluvialis.* A. Male, and D, female, Imboden, Arkansas. B. Female with eggs and young, and C, female from Bergen, New York. E, F. Cherokee County, Kansas. All × ⅘. From Smith (1946). Photos by A. A. and A. H. Wright (A-D), and by E. H. Taylor (E, F).

Kansan Subspecies.—The subspecies occurring in this state is *Eumeces anthracinus pluvialis* Cope, with type locality at Mobile, Alabama. One other race is recognized in the eastern United States.

References.—Taylor, 1935: 373-387, figs. 62, 63, pl. 32 (monograph); Smith, 1946: 372-375, fig. 116, pl. 103, map 30 (description, natural history, distribution).

Common Five-lined Skink

Eumeces fasciatus (Linnaeus)

Lacerta fasciata Linnaeus, Syst. Nat., ed. 10, vol. 1, 1758, p. 209 (type locality—Charleston, South Carolina).
Eumeces fasciatus Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 45.

Range.—Eastern third of the state. Peripheral western localities are in Sumner, Sedgwick (Wichita), Chase (6 miles south of Clements), Geary (Ft. Riley), Riley (Manhattan), and Doniphan (Doniphan Lake) counties. The record for Ransom, Ness County, based upon a K. U. specimen, needs verification.

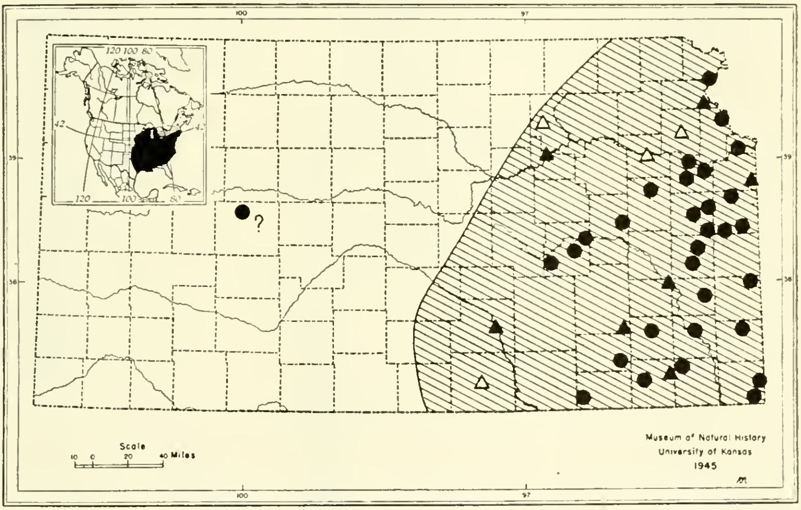


FIG. 137. Distribution of the common five-lined skink, *Eumeces fasciatus*, in Kansas, with insert showing range of the species.

Description.—Scales of body smooth, overlapping, twenty-five to thirty-one around middle of body (usually 28 or 30); head scales few, regular, including among others of importance seven supralabials; two well-defined, rather large postlabials between last supralabial and ear; two postmentals; median row of subcaudals greatly widened.

Young more or less uniform black above, except for five narrow white lines, including a median one that forks on the nuchals (rear of head) and reunites on the rostral; a pair of dorsolateral light stripes on the third and fourth scale rows; a lateral light stripe from sides of head through ear opening to hind leg; throat and snout cream, rest of ventral surfaces bluish-gray; dorsal surface of tail azure blue, very brilliant on distal half. As specimens attain larger size, brownish streaks form along the middle of the dark areas between the light stripes, and expand until little or none of the black

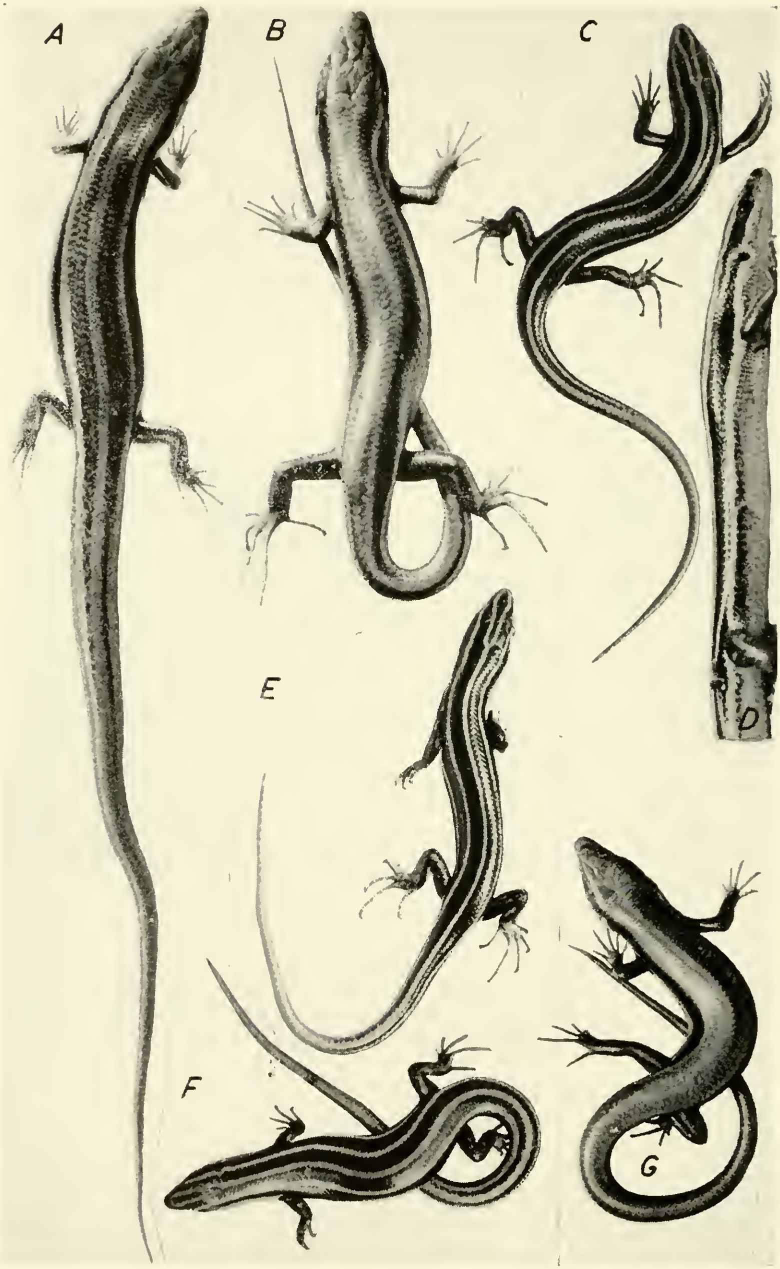


FIG. 138. Common five-lined skink, *Eumeces fasciatus*. A. Locust Grove, Mayes County, Oklahoma, × 9/10. B. Ithaca, New York, × 2/5. C, E. Pennsylvania State College Campus, × 9/10. D, × 9/10, F, × 2/5, G, × 2/5, from Lawrence, Kansas. From Smith (1946). Photos by A. A. and A. H. Wright (B-G), and U. S. Fish and Wildlife Service (A).

remains. The lateral dark bands remain darker than the rest of the body, but even these become lighter with greater age; the tail loses all trace of the blue color. This condition occurs in young males and in all adult females, which do not lose the stripes except on the head where they may become dim. In old males all stripes may disappear except for the dark lateral stripes; the head becomes reddish, at least in the breeding season, and the back is olive or olive-brown.

Size moderate, the snout-vent measurement reaching three and one-eighth inches. The tail is a little less than twice the head-body length.

Recognition Characters.—The smooth, flat scales identify the skinks. This species, which is often confused with *E. anthracinus* and *E. septentrionalis* differs from them in a number of scale characters as well as in details of pattern. The most conspicuous differences are listed in the key. See discussion also of *E. anthracinus.*

Habits and Habitat.—This species is commonly found in wooded areas, usually on the ground, under stones, in piles of leaves and in rotten logs. A moist but not wet environment is preferred.

These lizards frequently sun themselves in open areas in the hot part of the day, but because of their nervous temperament they seldom remain long in one place. They wander considerably, but on cool days may not emerge at all. They seem to wander within circumscribed areas, and have habitual retreats. Because of their wariness, specimens are seldom seen abroad even when abundant, but more frequently under objects where they have taken refuge.

They mate soon after emerging from hibernation. A preliminary courtship consists of scratching the ground or rubbing the ground with the cloaca. Active courtship on the part of the male consists of rushing, with open mouth, any lizard of the same species that may be around; if the latter fights or runs away, it is probably a male, but if it submits, it is a female and mating generally ensues. In copulation the male grasps the female by the side of the neck with his jaws, curling his cloaca underneath that of the female. One of the two hemipenes (either one) is used. Courtship lasts some five to seven minutes, and mating four to eight minutes.

Eggs are laid after six to seven weeks, in a two-week period in early summer. Hatching requires an average of five to six weeks. The eggs are laid in clutches of from two to eighteen, in rotten logs or loose soil several inches below the surface, and are brooded for the entire incubation period by the female. Intruders are courageously attacked. At hatching, the young measure 24 to 27.5 mm. from snout to vent.

Winter is spent in rotten logs or underground; one was found hibernating in a pile of sawdust and others, in Kansas, have been found as deep as eight feet in the ground. The earliest recorded date of emergence in Kansas is April 6.

The food consists of almost any small moving animal, including many kinds of arthropods and even small vertebrates.

Kansan Subspecies.—No subspecies of this species have been defined anywhere in its range.

References.—Burt, 1928: 61-62 (food); Burt, 1928: 51-56, map fig. 11 (description, habits, habitat, Kansas localities); Smith, 1946: 347-351, figs. 95, 109, 111, pl. 93, map 26 (description, natural history, distribution); Taylor, 1935: 188-212, figs. 24-27, pl. 13 (monograph); Fitch, 1954 (complete life history, ecology).

Greater Five-lined Skink

Eumeces laticeps (Schneider)

Scincus laticeps Schneider, Hist. Amph., 1801, vol. 2, p. 189 (type locality—Charleston, South Carolina, by subs. design.).

Eumeces laticeps Peters, Monatsb. Acad. Wiss. Berlin, 1864, p. 49.

Range.—Extreme eastern central part of the state. Recorded only from Murray Lake, Miami County, and a locality 4 miles west of La Cygne, Linn County.

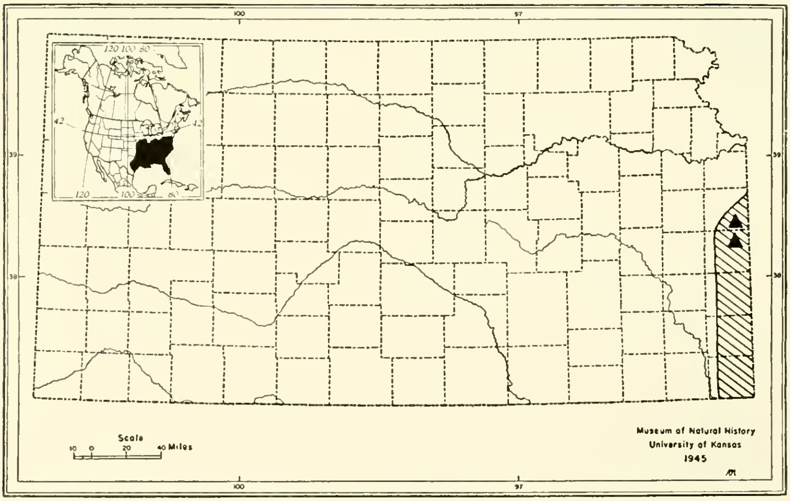


Fig. 139. Distribution of the greater five-lined skink, *Eumeces laticeps*, in Kansas.

Description.—Scales of body smooth, overlapping, rounded at free edge, twenty-eight to thirty-four around middle of body (usually 30 or 32); head scales few, regular, including among others of importance a postnasal, two postmentals, seven or often eight supralabials; postlabials tiny (if paired), single, or absent; median row of subcaudals greatly widened.

Young more or less uniform black above except for five narrow white lines; median line forking on nuchal scales at rear of head; dorsolateral lines on third and fourth, fourth and fifth, or fourth scale-row only; lateral light stripe extending from sides of head to upper edge of ear opening, and then from middle of rear edge of ear opening to hind leg; tail a striking azure blue, brilliant on distal half; throat and snout cream, belly bluish-gray to white. Half-grown examples and young adult females have light brown streaks in the

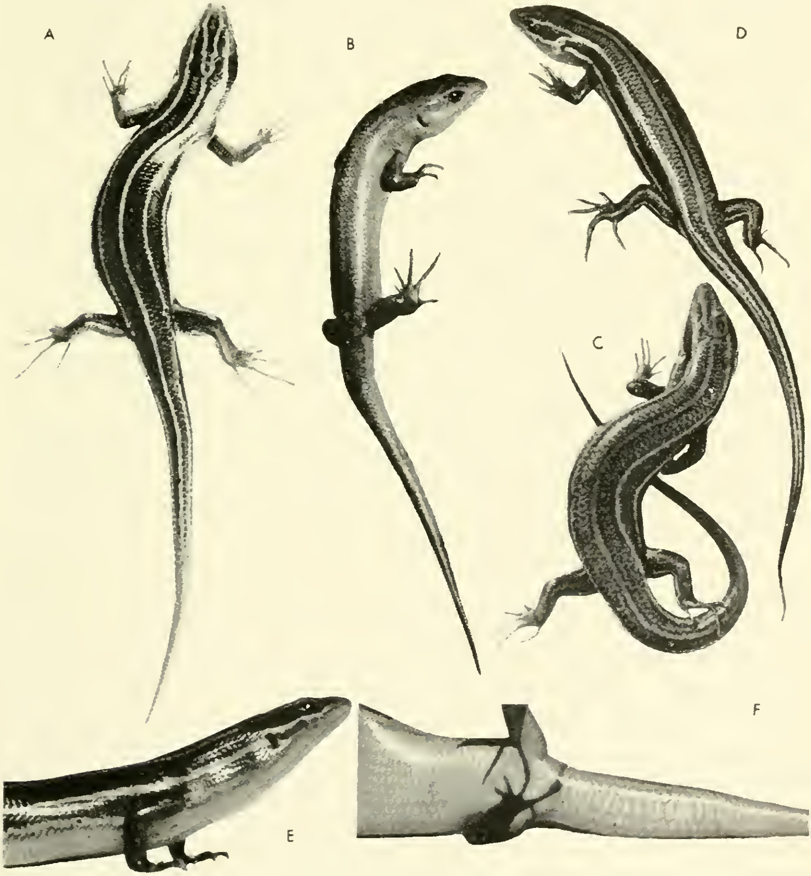


FIG. 140. Greater five-lined skink, *Eumeces laticeps*. A, Stove Lake near Turrell, Arkansas; B, Boliver, Tenn.; C, Waverly Mills, South Carolina. From Smith (1946). Photos by A. A. and A. H. Wright (C, E, F), Gloyd (B, D), and U. S. Fish and Wildlife Service (A). A, D, E, × ⅔; B, × ⅖; E, F, × 1.

dark fields between the light stripes, and the tail is slate. In old adult females and all adult males the stripes tend to disappear completely, and the lateral dark field is the last to go; in such specimens the entire dorsal surface is uniform light brown. In the breeding season adult males have a reddish head, and the jaw muscles are so enlarged as to give the rear of the head a swollen appearance.

Size large, the snout-vent measurement reaching five inches. The tail when intact is a third or a half greater than the head-body length; a regenerated tail is shorter, but is often so similar in appearance to the original tail as to be distinguishable only by reference to the midventral scales, which are wider than those on the intact part of the tail.

Recognition Characters.—The smooth, flat, rounded scales identify the skinks. The possession of five light lines and a postnasal readily separates this species from all others occurring in Kansas, with the exception of *E. fasciatus.* These two species are extraordinarily similar; they are among the best examples of "sibling" species known in vertebrates. No known character will distinguish all examples. *E. laticeps* reaches a much larger size, lays larger eggs, produces larger, broader-headed young; it more frequently has 8 supralabials and the dorsolateral light stripe not involving the third scale row; seemingly the most reliable character is the reduction of the postlabials to two tiny scales, or to one scale, or to nothing whatever.

Habits and Habitat.—This species is restricted to wooded regions, where it is commonly found in logs or piles of brush and in or on standing trees. It is of more arboreal habits than the common species, but is often found on or near the ground. Its habits appear to be virtually the same as those of *E. fasciatus* (which see). The egg clutch appears to be a little smaller, of 6 to 10 eggs as opposed to 2 to 18 in *E. fasciatus.* The eggs when laid measure about 15 × 10 mm., and near hatching time about 20 × 14 mm. The hatchlings measure 30.5 to 32 mm. snout to vent.

The bite of large males is exceptionally powerful and may draw blood. Specimens never become docile, but they do learn to tolerate captivity. Captive specimens have been kept for years on a diet of mealworms and miscellaneous insects as they become available.

Kansan Subspecies.—No subspecies of this species have been defined anywhere in its range.

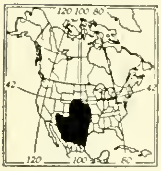
References.—Anderson, 1950:53 (report from Kansas); Smith, 1946: 353-356, figs. 108, 110, pl. 95, map 27 (description, natural history, distribution); Taylor, 1936: 212-224 (monograph).

Sonoran Skink

Eumeces obsoletus (Baird and Girard)

Plestiodon obsoletum Baird and Girard, Proc. Acad. Nat. Sci. Phila., vol. 6, 1852, p. 129 (type locality—Valley of Rio San Pedro, tributary of Rio Grande del Norte, Texas).

Eumeces obsoletus Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 45.



Range.—Apparently state-wide; presumably occupies the northwestern corner of the state, but has not been reported northwest of Hamilton (Syracuse), Logan (Oakley), Osborne and Jewell (Mankato) counties.

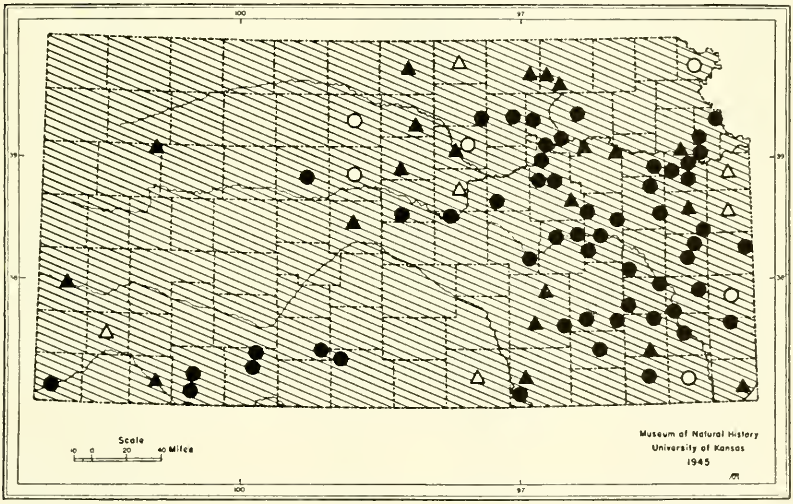


FIG. 141. Distribution of the Sonoran skink, *Eumeces obsoletus*, in Kansas.

Description.—Scales on body smooth, flat, twenty-eight around middle of body, those on sides in rows obliquely rising dorsad as they extend posteriorly; at least seven scale rows on back parallel to each other; two postmentals; usually no postnasal; subcaudals considerably widened.

Adults light slate gray; a dark border around each scale usually, sometimes so expanded that a somewhat lined pattern is evident; venter unmarked. Young, black with a blue tail; most scales on head with a rounded, bluish white or orange spot. Specimens intermediate in size show intermediate stages in the change from the youthful to the adult pattern. The juveniles were long thought to represent a distinct species, so different is their pattern from that of the adults.

Size rather large, the snout-vent measurement reaching 4⅞ inches. Tail about 1½ times as long as head and body.

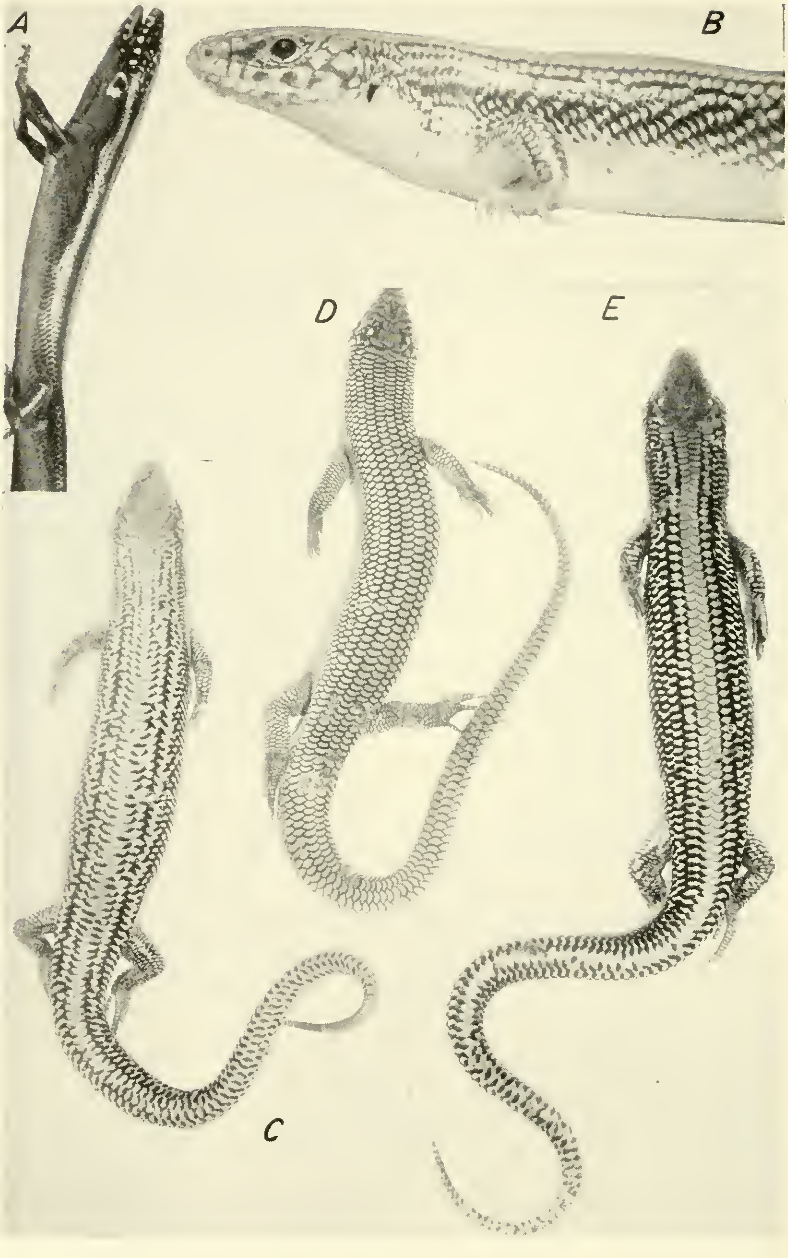


Fig. 142. Sonoran skinks, *Eumeces obsoletus.* A, × ½, B, × 2, C, × ⅔, E, × ⅔, from Lawrence, Kansas. D, × ⅔, Cameron County, Texas. From Smith (1946). Photos by A. A. and A. H. Wright (A, B, D), and E. H. Taylor (C, E).

Recognition Characters.—The combination of smooth, uniform scales around the body, with the oblique position of the lateral scale rows, is distinctive of this species. As a rule no other skink of the state has the lateral scale rows oblique; they parallel the dorsal scale rows. But on rare occasion (see in *E. septentrionalis*) some of the lateral scale rows are diagonal, much as in *E. obsoletus.* In the former species, however, not so many of the lateral rows are diagonal in the abnormal specimens examined, and it is believed that none would have so few as seven middorsal scale rows parallel with each other; that number is the maximum in *E. obsoletus.* The species is so distinct that it is not often confused with any other.

Habits and Habitat.—This species is found most commonly on grassy or somewhat wooded hillsides underneath loose, flat, limestone rocks. Rough country seems to be preferred, but like *Sceloporus u. garmani,* this skink may be found even on flat prairie if there are enough burrows of mammals to afford protection Its distribution is especially spotty in the latter habitat.

Like the other skinks, these lizards are so secretive and shy that they are seldom seen even though they are common and diurnal. They are active as early as late March, and as late as early October. They hibernate in burrows underground, at depths of as much as ten inches.

These are among the most vicious lizards of the state. They do not tame well, and their powerful jaws may well lacerate the skin since only small pinches are taken at any one time. When releasing a grip, they wriggle energetically immediately in advance.

Mating occurs from late April to the middle of June, and may last for four to five minutes. The male grasps a fold of the side of the neck of the female in his jaws, and curls the cloaca under that of the female when copulating with her.

Eggs are laid from the middle of June to the middle of July. Seven to fifteen are laid in a nest where the female usually remains until the eggs hatch in late August.

The food consists of a wide variety of small arthropods. Males have eaten the eggs of their own species. Ground beetles and ladybird beetles are rejected.

Kansan Subspecies.—No subspecies have as yet been defined anywhere in the range of this species, although several are to be expected.

References.—Burt, 1928: 62-63 (food); Burt, 1928: 58-63, map fig. 13 (description, natural history, Kansas records); Smith, 1946: 362-365, figs. 100, 101, pl. 99, map 29 (description, natural history, distribution); Taylor, 1935: 305-320, figs. 47, 48, pl. 24 (monograph completely summarizing natural history, structural and geographic variation).

Prairie Skink

Eumeces septentrionalis (Baird)

Plestiodon septentrionalis Baird, Proc. Acad. Nat. Sci. Phila., 1858: 256 (type locality—Fort Ripley, Minnesota).
Eumeces septentrionalis Cope, Bull. U. S. Nat. Mus., no. 1, 1875: 44.

Range.—The eastern third and south-central quarter of the state. The western subspecies, *E. s. obtusirostris,* is known from only two localities: Schwartz Cañon, Comanche County, and Norwich, Kingman County. The eastern subspecies, *E. s. septentrionalis,* is recorded as far west as Pottawatomie (5 miles north of Onaga), Russell (7 miles south and 2 miles east of Russell), Chase (6 miles south of Clements), Woodson (Neosho Falls) and Cherokee counties.

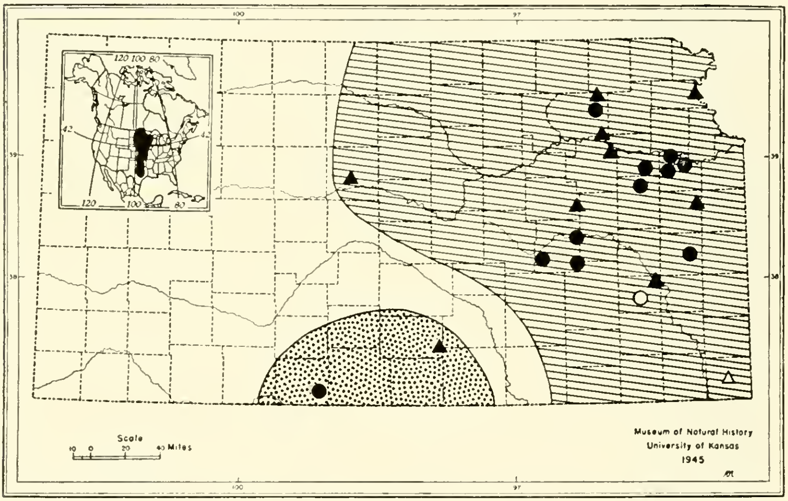


FIG. 143. Distribution of the prairie skink, *Eumeces septentrionalis,* in Kansas, with insert showing range of the species. The range of *E. s. septentrionalis* is indicated by the lined area, that of *E. s. obtusirostris* in the south by the stippled area.

Description.—Scales on body perfectly smooth, shiny, flat, usually in twenty-six or twenty-eight rows around middle of body; head scales relatively large, regular, including among others of importance two postmentals; postnasal usually absent; frontonasal small, sometimes absent, seldom in contact with anterior loreal (a scale to each side of the frontonasal).

Ground color olive to olive-brown; dorsolateral light lines extending from above eye along the fourth or adjacent edges of fourth and fifth scale rows onto tail; lateral light lines from sides of head through ear, above arm and to tail; a narrow dark line below lateral light line, and a broad brown band occupying the space between the lateral and dorsolateral light lines; bordering the dorsolateral light lines medially is another brown band involving two half scale rows; on the adjacent edges of the first and second scale rows, from the nuchal region to the tail, extends another dark brown stripe on each side; these three lines of ground color (not light color as in the dorsolateral and lateral light stripes) are enclosed by four dark bands; in some specimens the dark bands on either side of the middle of the back are poorly defined. Tail bright blue in young, the color disappearing at a snout-vent length of about two inches.

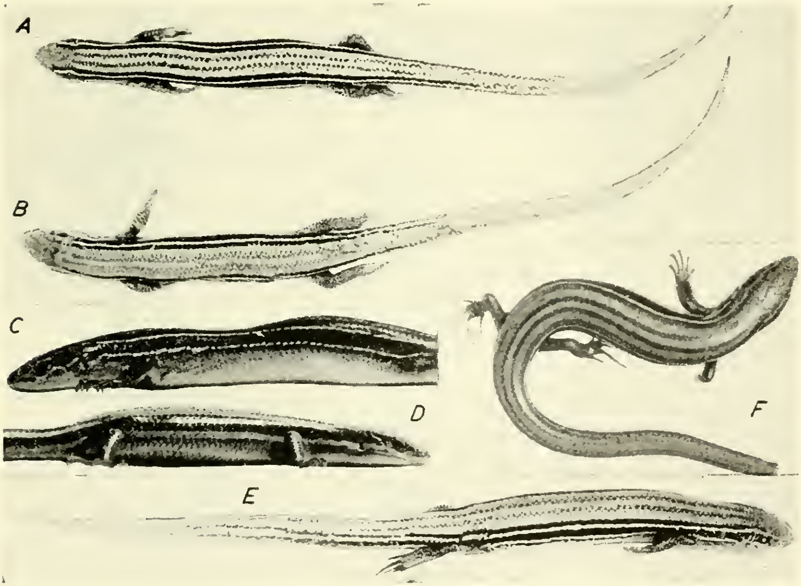


FIG. 144. Prairie skink, *Eumeces s. septentrionalis*, × ⅔. A, B, E, Onaga, Pottawatomie County, Kansas. C, F, Lawrence, Douglas County, Kansas. D, Ice Caves, northeastern Iowa. From Smith (1946). Photos by A. A. and A. H. Wright.

Size moderate, the snout-vent length reaching 3¼ inches; the tail, but little longer than the head and body in young specimens, becomes proportionately about twice as long in adults.

Recognition Characters.—This species is often confused with *E. fasciatus*, although there are many details that differ. See the key for a list of the conspicuous differences.

Habits and Habitat.—Open grassy hillsides provided with small, flat rocks are the best places to find these lizards.

They appear to have a very spotty distribution; at any rate they have been found at relatively few localities in the state. Although

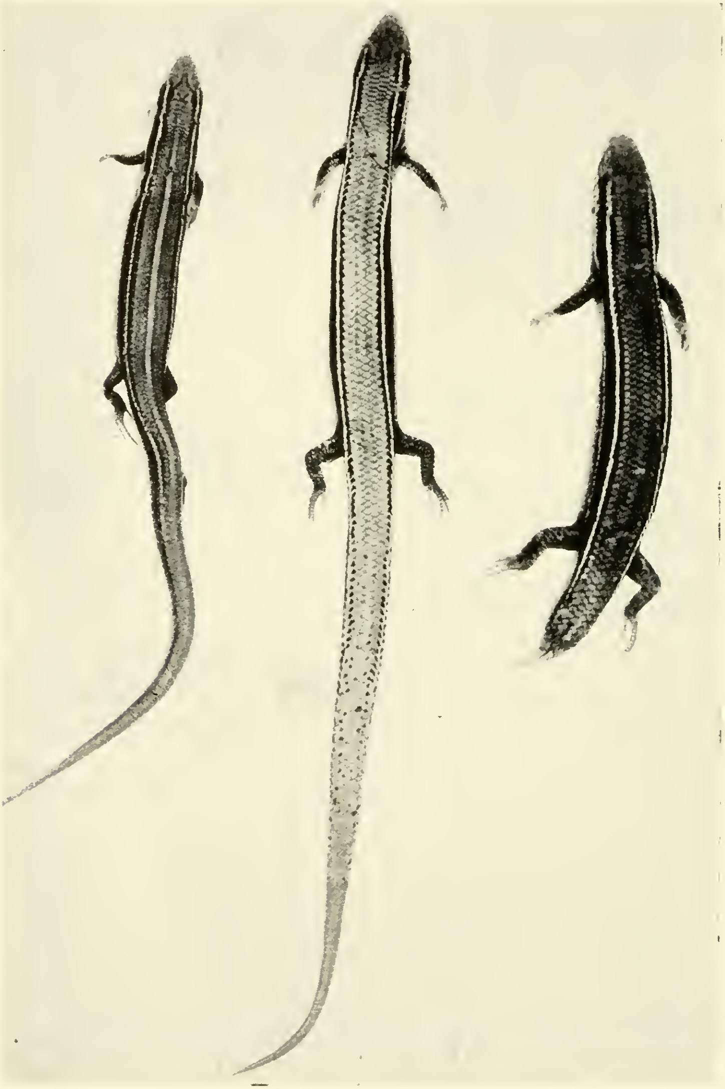


FIG. 145. Prairie skink, *Eumeces s. obtusirostris*, × 1, Waco, McLennan County, Texas. From Smith (1946). Photos by E. H. Taylor.

rarely seen in the open, probably they are diurnal. Because they seek cover in advance of the near approach of an observer, they may only appear always to be under cover.

Nothing is known of the natural history of the southern race. In the northern race, *E. s. septentrionalis*, a number of facts are known owing to the work of Breckenridge in Minnesota. Mating occurs in May or early June, and five to thirteen eggs are laid in excavations in loose, moist soil under boards, stones and other objects, in late May and June. In an average of forty-six days the eggs hatch, and the hatchlings measure 24 to 26.5 mm. snout to vent. After hibernation through the first winter, growth is rapid, at an average rate of .37 mm. per day, and in the second year it proceeds at the rate of .31 mm. per day, but in subsequent years it is much slower. Maturity is reached by the end of the second year, with attainment of a length of 65 mm. from snout to vent.

The food consists of small invertebrates such as insects, snails, and spiders; small vertebrates, even young of its own species, are sometimes eaten.

Enemies of this and other similar lizards include hog-nosed snakes, hawks, owls, skunks, raccoons, and ground squirrels.

In Minnesota, most of these skinks become inactive in September, and begin hibernation in October. In Iowa, a group of fifty-two specimens was found 4½ feet below the surface of the ground in a gravel pit. Males emerge from hibernation before the females (as in many other species), in April or early May, but females do not emerge until later in May, in Minnesota.

Kansan Subspecies.—Two races are known in Kansas: *Eumeces septentrionalis septentrionalis* (Baird), and *Eumeces septentrionalis obtusirostris* Bocourt. The type locality of the latter is in "Texas." These two subspecies can be identified by reference to the accompanying table of differences. A third subspecies occurs in Texas.

E. s. septentrionalis	*E. s. obtusirostris*
1. Frontonasal small, usually not in contact with anterior loreal on each side.	1. Frontonasal large, usually in contact on each side with anterior loreal.
2. Ground color usually light gray.	2. Ground color usually very dark.
3. Dark borders of median light line present but frequently broken and poorly defined.	3. No dark borders on median light line.
4. Dark lines bordering dorsolateral light lines well defined, broad.	4. Dark lines bordering dorsolateral light lines poorly defined.

Reference.—Taylor, 1935: 394-410, pls. 28, 34 (monograph).

FAMILY TEIIDAE

Genus *Cnemidophorus* Wagler

Six-lined Racerunner

Cnemidophorus sexlineatus (Linnaeus)

Lacerta sexlineata Linnaeus, Syst. Nat. ed. 12, vol. 1, 1766, p. 364 (type locality—Charleston, South Carolina).

Cnemidophorus sexlineatus Duméril and Bibron, Erp. Gén., vol. 5, 1839, p. 1.

120 100 80
42
120
100
80

Range.—State-wide.

Description.—Dorsal scales small, granular, seventy-six to ninety-three from one side to the other at about the middle of the body; large, flat, quadrangular belly plates, not overlapping, in eight longitudinal rows; two gular folds, the posterior overlapped anteriorly by enlarged scales; head plates large; scales on limbs variable, some large, others small.

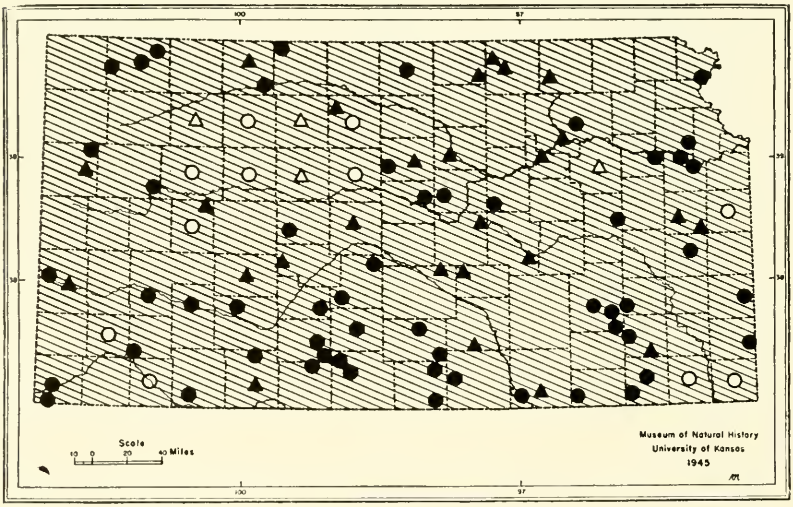


Fig. 146. Distribution of the six-lined racerunner, *Cnemidophorus sexlineatus,* in Kansas.

Six, well-defined, narrow, longitudinal, light pale blue to yellowish lines on body in females and in young, all extending from head to base of tail or groin; the lateral stripe passes through the ear; the dorsolateral stripes begin at the posterior corner of the eye, and the others begin near the median edge of the parietal; back and sides between these stripes usually black; the area between the middle stripes is brownish; belly white. Adult males with the same dorsal pattern; lateral stripes and dark areas above them indistinct, merged with belly color; black between dorsolateral and median stripes less intense; belly and throat suffused with pale blue.

Size moderate, the snout-vent length reaching 3 inches; the tail is long and slender, about 2⅟₁₀ to 2⅓ times the head-body length.

Recognition Characters.—This is the only lizard in Kansas with granular, uniform dorsal scales combined with the presence of large,

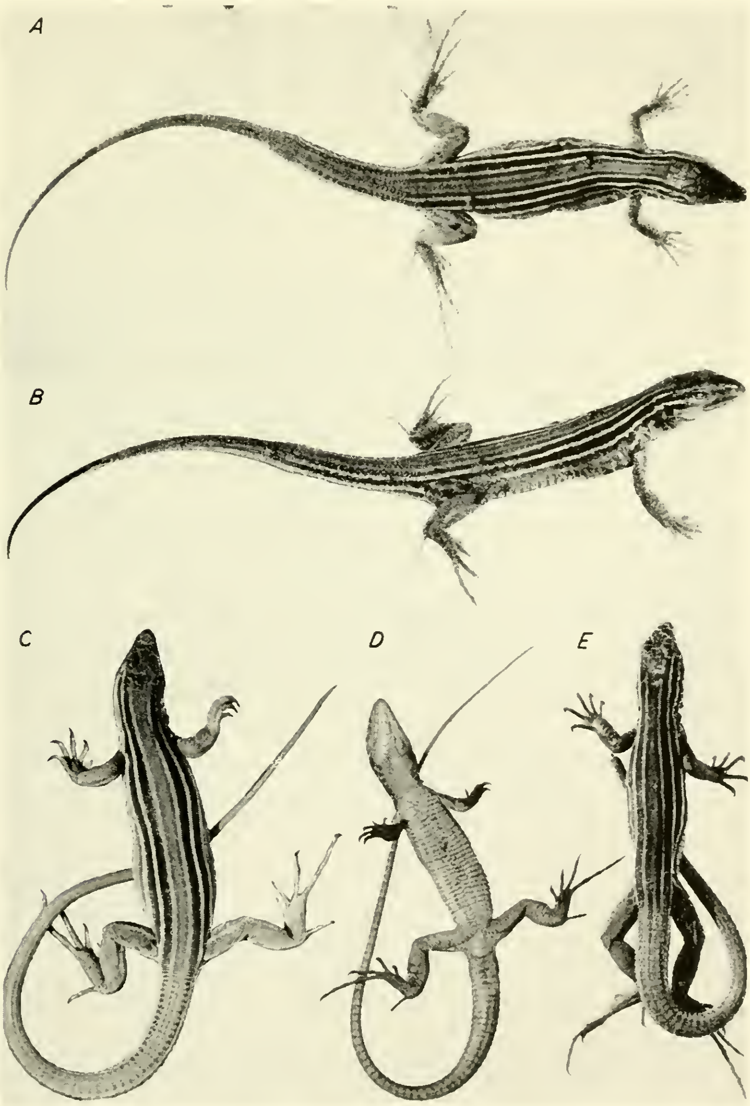


FIG. 147. Six-lined racerunners, *Cnemidophorus sexlineatus*, all × ⅔, except D which is × ½. A, B, Cape Henry, Virginia. C. Three miles east of Sharon Springs, Kansas. D. St. Petersburg, Florida. E. Key West, Florida. From Smith (1946). Photos by A. A. and A. H. Wright (C-E), and U. S. Fish and Wildlife Service (A-B).

juxtaposed (not overlapping), quadrangular ventrals many times as large as the dorsals. No other species is easily confused with it.

Habits and Habitat.—The habitat is in relatively dry areas, where sandy or other loose soil, short grass, and other kinds of low vegetation occur. The chief requirement seems to be a certain degree of dryness. The land may be flat or hilly, and the soil coarse or fine.

These are moderately wary lizards frequently seen in places where they occur, but seldom caught by hand unless special effort is made to run them down or dig them out of holes to which they retreat when pursued. They can dig their own burrows, but frequently use burrows made by other kinds of animals. In digging they use their front legs to remove the soil. The burrows extend to depths of eight to ten inches. It is said that the burrows are used as retreats at night, and for laying eggs. Probably they hibernate in such burrows, many of which may be constructed in a year.

Activity begins early in the morning on warm days and falls off in the afternoon; in late afternoon the lizards retire completely. On cool or cloudy days they may not emerge at all. These are among the fastest of Kansan lizards, being able to run at the rate of about 18 miles per hour. Their speed requires further check.

The food consists of practically any small, moving animals found, save ladybird beetles. Soft-bodied insects are preferred.

Mating occurs in spring, probably not later than two or three weeks after emergence from hibernation. Courtship by the males includes a preliminary rubbing of the cloaca upon the ground, dashing in figure eights in front of a prospective mate, and the chasing and nipping of any other individuals of the species that may be in the vicinity. Reception of his attention by any females is immediately followed by a five-minute period of copulation, during which time the male grasps in his jaws some loose skin on the posterior part of the back of the female.

The eggs, four to six in number, are laid from as early as the first part of June until as late as the middle of July, four to twelve inches below the surface, or frequently under some object on the surface such as a log. Mole tunnels may frequently be used, the lizards making side tunnels in which the eggs are deposited. The eggs hatch in August.

Kansan Subspecies.—No subspecies are currently recognized anywhere in the range of this species.

References.—Burt, 1928: 58-61 (food); Burt, 1928: 38-46 (description, natural history, localities in Kansas); Burt, 1931: 76-97 (monograph); Smith, 1946: 415-418, figs. 13, 122, pl. 116, map 33 (description, natural history, distribution).

FAMILY ANGUIDAE

Genus *Ophisaurus* Daudin

Glass-snake Lizard

Ophisaurus attenuatus Baird

Ophisaurus ventralis attenuatus Baird, *in* Cope, Bull. U. S. Nat. Mus., no. 17, 1880, p. 18 (type locality—Cook County, Texas).
Ophisaurus attenuatus Boulenger, Cat. Liz. Brit. Mus., vol. 2, 1885, p. 282.

Range.—Eastern half of the state. Westernmost records are in Washington (3 miles southeast of Haddam), Graham, Ellis, Ellsworth (Ellsworth), McPherson, Butler, and Barber (Sharon) counties.

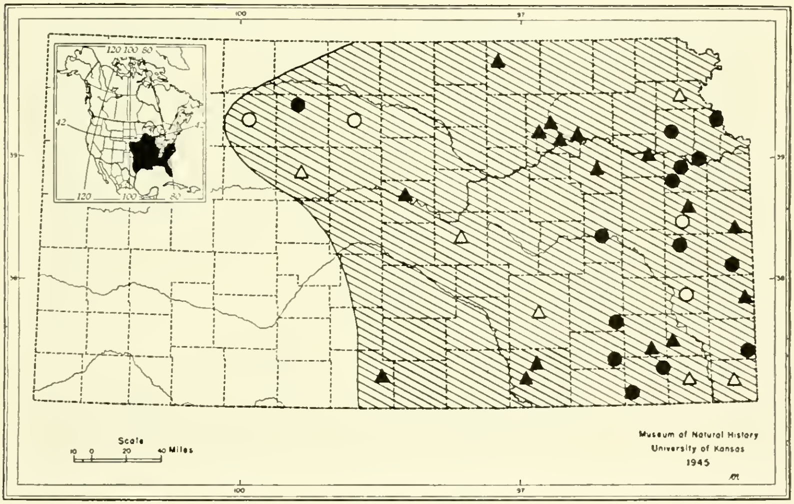


FIG. 148. Distribution of the glass-snake lizard, *Ophisaurus attenuatus*, in Kansas, with insert showing range of the species.

Description.—No evidence whatever exists externally of either the front or the hind legs; head scales large or small, regular in position; eyelids present; ear openings small, about halfway between eye and anterior ends of a deep longitudinal fold extending along each side of belly to side of anal region; dorsal scales from interparietal to base of tail 118 to 124, in 14 to 16 longitudinal rows; scales toward middle of back sometimes convex or with a round keel; ventral scales in ten rows, about same size as dorsals, flat; tail scales like those on body; no lateral fold on tail.

Dorsal ground color light gray to brown, covering head, body in a broad median area involving six scale rows and the edge of the adjacent row on each side, and the tail in an area involving four scale rows; ground color sharply differentiated laterally from the dark brown sides, the color broken only by narrow light lines extending along either the middle or edges of the scale rows; brown lateral color fading into white or cream near lateral fold; sides of head also usually dark, with vertical alternating light and dark bars of varying distinctness; a few dark marks on lower lips. Back nearly uniform, or with a median dark stripe, or a narrow dark streak on each scale row; ventral surfaces of belly and tail entirely white, with the exception of dark streaks along lateral scale rows in some specimens.

Size large, snout-vent length reaching 9¾ inches; tail considerably longer, about 1⅗ to 2 times length of head and body. The length of an extraordinarily large specimen has been recorded as 37½ inches; ordinarily adults do not exceed 28 inches in total length.

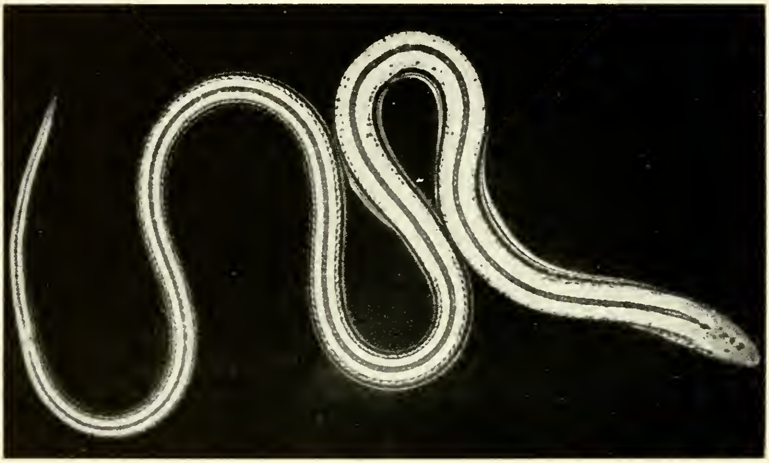


FIG. 149. A glass-snake lizard, *Ophisaurus a. attenuatus*, × ⅔, K. U. no. 23605, Lawrence, Douglas County, Kansas. Photo by W. W. Tanner and T. P. Lyle.

Recognition Characters.—The absence of legs is a totally reliable means of identification of this species of lizard, if indeed it is properly recognized as a lizard by anyone who captures or examines specimens of it. The presence of an ear opening will readily distinguish the species from the animals it most closely resembles, the snakes.

Habits and Habitat.—These lizards are found on the ground in moist, grassy open areas in wooded regions. They are said to burrow a great deal and are frequently unearthed by plowing. They are seldom seen in the open, unless startled from some cover; apparently they are diurnal. After heavy rains they are said to emerge in abundance. The skin is shed almost entire whereas in most other lizards it is shed in large patches.

The food consists, as in other lizards, of insects and their larvae, spiders and other arthropods, and small snails. It is said that other lizards as well as snakes are eaten, and that at least in captivity they may be cannibalistic.

Eight to seventeen eggs are laid from early June to early August, and are brooded by the female, which turns the eggs from time to time, but makes no effort to defend the eggs as skinks do theirs. The eggs of *Ophisaurus* hatch in from fifty-six to sixty-one days, and the young measure approximately five inches in total length.

One of the most celebrated characteristics of this species is that of the ready parting of the tail. If the animal is handled, it may by violent squirming suddenly break the tail from the body, sometimes into several pieces, and while the vital portion glides quietly away the parts of the tail thrash and bound so energetically that no attention is given to the escape of the animal. At least, such apparently is the purpose of the adaptation for breaking the tail so readily. The superstitions that the parts of the tail grow back together, or that they reunite with the body at sometime, or that they can grow new individuals, all are entirely false. The lost tail degenerates or is eaten by other animals, and the lizard itself grows a new tail from the remaining stump. The new tail is shorter than the original and lacks the uniform pattern; its internal structure likewise is different. Skinks have been known deliberately to break off and eat their tails as food, and it is possible that this species also may do it. In early stages of regeneration the tip of the tail has a spinelike or spurlike appearance, giving rise to the erroneous supposition that the structure constitutes a sting.

Kansan Subspecies.—Only *O. a. attenuatus* occurs in this state. One other subspecies and two other monotypic species of this genus are recognized in the extreme southeastern United States.

References.—Burt, 1928: 58 (food); Burt, 1928: 36-38, map fig. 7 (description, habits, habitat, Kansas distribution); Smith, 1946: 466-470, figs. 2, 134, pl. 133 (description, natural history, distribution); McConkey, 1954: 147-171, fig. 5, pl. 2 (taxonomy, natural history).

Snakes

Suborder Serpentes Linnaeus

Forty species of snakes, six of which are represented by two subspecies each, are known from the state of Kansas. Three other species are to be expected. These belong to only three families, two of which (Colubridae, Crotalidae) belong to the superfamily Colubroidea, whereas the third (Leptotyphlopidae) belongs to the superfamily Typhlopoidea. At least eleven other families and one other superfamily (Boidoidea) occur elsewhere in the world. Only two other families (Elapidae, Boidae) occur in the United States.

Numerous taxonomic and ecological problems exist pertaining to snakes, as well as to other groups of reptiles and amphibians within the boundaries of Kansas. A detailed study of geographic variation, with special emphasis upon areas of intergradation, is highly desirable, for most intergrading zones can now be but roughly approximated. Such a study is prerequisite for any definitive approach to a zoogeographic analysis of the state. As implied by Peters (1955), the conventional concept of faunal provinces may require extensive revision; only a detailed distributional and variational study will reveal the extent and nature of revision that may be necessary.

The accompanying figures (Figs. 150, 151) may be of value in use of the following keys. Most of the features commonly used in classifying snakes are indicated there.

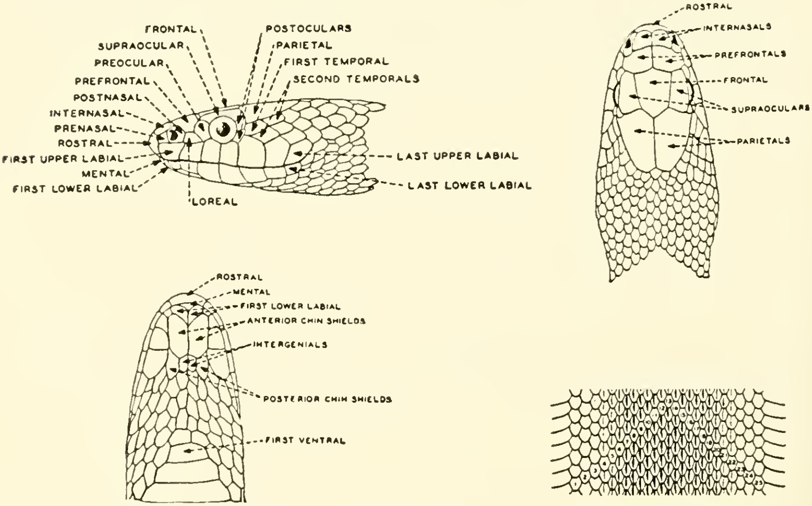

FRONTAL
SUPRAOCULAR
PREOCULAR
PREFRONTAL
POSTNASAL
INTERNASAL
PRENASAL
ROSTRAL
FIRST UPPER LABIAL
MENTAL
FIRST LOWER LABIAL
LOREAL
POSTOCULARS
PARIETAL
FIRST TEMPORAL
SECOND TEMPORALS
LAST UPPER LABIAL
LAST LOWER LABIAL
ROSTRAL
INTERNASALS
PREFRONTALS
FRONTAL
SUPRAOCULARS
PARIETALS
ROSTRAL
MENTAL
FIRST LOWER LABIAL
ANTERIOR CHIN SHIELDS
INTERGENIALS
POSTERIOR CHIN SHIELDS
FIRST VENTRAL

Fig. 150. Names of certain scales used in classification of snakes. Drawing of a king snake, *Lampropeltis*, × 3/5. From Perkins (1940).

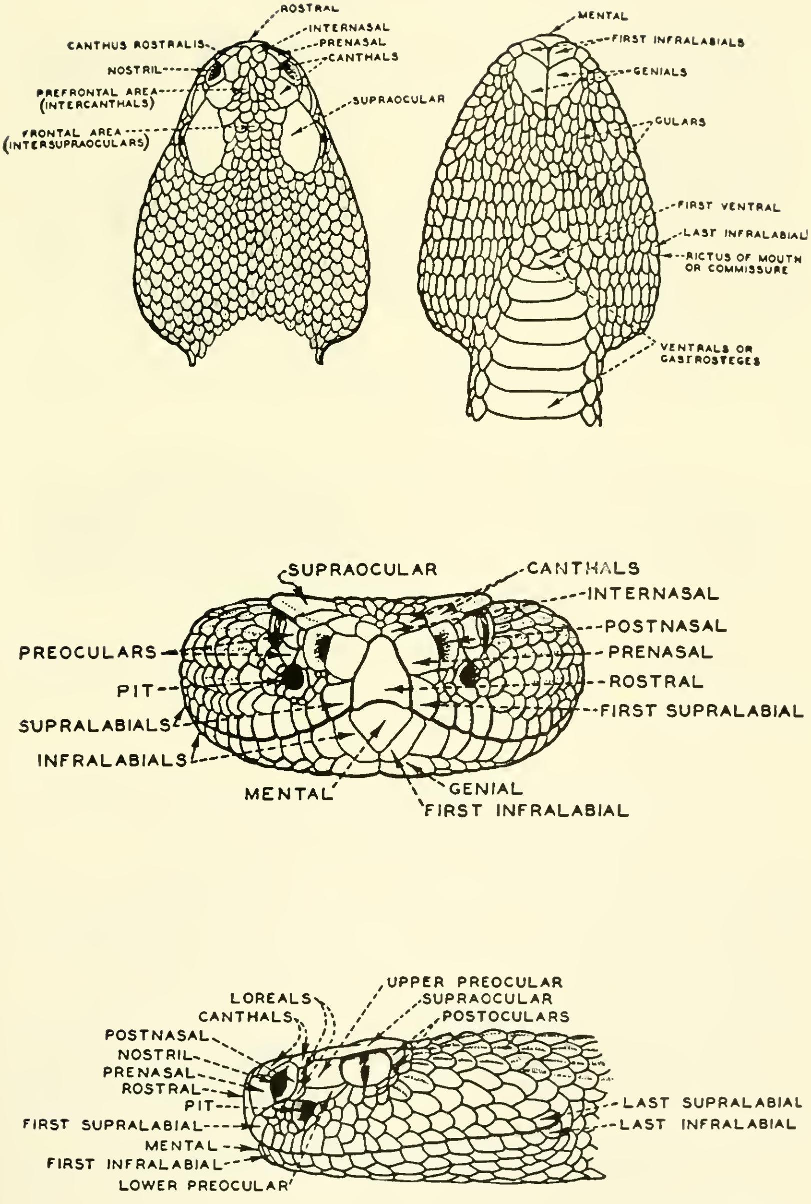

ROSTRAL
INTERNASAL
PRENASAL
CANTHALS
CANTHUS ROSTRALIS
NOSTRIL
PREFRONTAL AREA (INTERCANTHALS)
SUPRAOCULAR
FRONTAL AREA (INTERSUPRAOCULARS)
MENTAL
FIRST INFRALABIALS
GENIALS
GULARS
FIRST VENTRAL
LAST INFRALABIAL
RICTUS OF MOUTH OR COMMISSURE
VENTRALS OR GASTROSTEGES
SUPRAOCULAR
CANTHALS
INTERNASAL
POSTNASAL
PRENASAL
ROSTRAL
FIRST SUPRALABIAL
PREOCULARS
PIT
SUPRALABIALS
INFRALABIALS
MENTAL
GENIAL
FIRST INFRALABIAL
UPPER PREOCULAR
SUPRAOCULAR
POSTOCULARS
LOREALS
CANTHALS
POSTNASAL
NOSTRIL
PRENASAL
ROSTRAL
PIT
FIRST SUPRALABIAL
MENTAL
FIRST INFRALABIAL
LOWER PREOCULAR
LAST SUPRALABIAL
LAST INFRALABIAL

FIG. 151. Nomenclature of certain scales used in classification of snakes. Drawing of a rattlesnake, *Crotalus*, × 1. From Perkins (1940).

KEY TO SPECIES OF SNAKES

1. Scales of equal size all around body (Fig. 152A).
Leptotyphlops myopica, p. 220

1′. Scales on belly much larger than other scales (Fig. 152B).

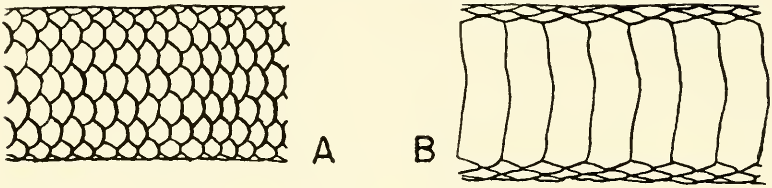


FIG. 152. A. Ventral scales of a blind snake, *Leptotyphlops*, × 6. B. A king snake, *Lampropeltis*, × 1. From Perkins (1940).

2. A large pit on either side of head between eye and nostril (Fig. 153B).

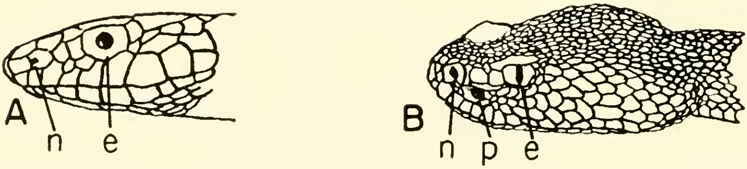


FIG. 153. A. Lateral view of the head of a snake lacking a facial pit. B. Lateral view of the head of a snake possessing a pit; e, eye; n, nostril; p, pit. From Perkins (1940), × 1.

3. Rattle (or any segment thereof, or a horny "button") absent (Fig. 154A).
    4. No loreal; usually 25 scale rows at middle of body.
    Ancistrodon piscivorus, p. 308
    4′. A loreal; usually 23 scale rows at middle of body.
    Ancistrodon contortrix, p. 304

3′. Rattle, or at least a segment thereof, or a horny "button," present (Fig. 154B).

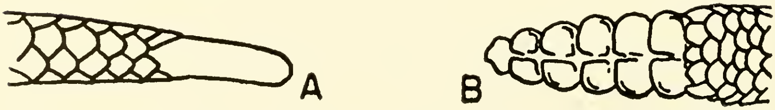


FIG. 154. A. The tail of a copperhead, *Ancistrodon contortrix*, × 5½. B. The tail of a rattlesnake, *Sistrurus catenatus*, × 1⅗. From Blanchard (1925).

4. Four large scales on top of head in front of eyes; other head scales relatively large (Fig. 155A).
    5. Dorsal blotches separated by interspaces 1.5 to 2 times as long middorsally as the blotches themselves.
    Sistrurus miliarius, p. 324
    5′. Dorsal blotches separated by interspaces shorter along the middorsal line than the blotches themselves.
    Sistrurus catenatus, p. 310

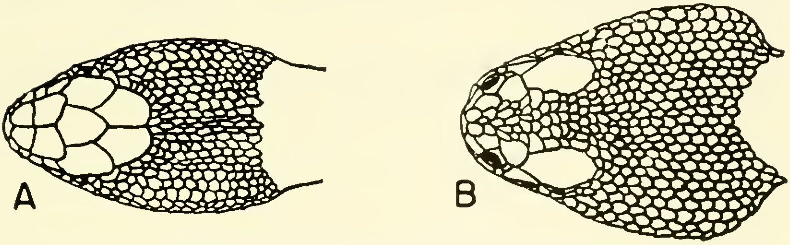


FIG. 155. A. The head scales of a massasauga, *Sistrurus catenatus*, × 1. B. The head scales of a rattlesnake of the genus *Crotalus*, × 1. From Perkins (1940).

4′. Numerous and only small scales (except supraoculars) over entire upper surface of head (Fig. 155B).
    5. Pattern of body consisting chiefly of crossbands (sometimes chevron-shaped) . . . . *Crotalus horridus*, p. 316
    5′. Pattern of body consisting of a median series of blotches less than 3 times as wide as long.
        6. Ground color and dark rings of tail distinctly different from those of body; blotches diamond-shaped, angular (pointed) laterally . . . . *Crotalus atrox*, p. 313
        6′. Ground color and dark rings on tail closely resembling those on body; blotches oval, not pointed laterally.
        Crotalus viridis, p. 318

2′. No pit between eye and nostril (Fig. 153A).
    3. Scale at tip of snout enlarged, sharp-edged, and with a sharp median, longitudinal keel (ridge) (Fig. 156).

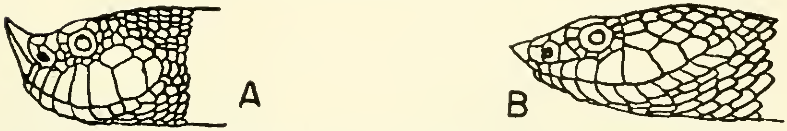


FIG. 156. A. Head scales of a western hog-nosed snake, *Heterodon nasicus*, × 1. B. Head scales of an eastern hog-nosed snake, *H. platyrhinos*, × 1. From Cope (1900).

4. In lateral profile, tip of snout abruptly turned up (Fig. 156A) . . . . *Heterodon nasicus*, p. 229
4′. In lateral profile, tip of snout almost straight above (Fig. 156B) . . . . *Heterodon platyrhinos*, p. 226

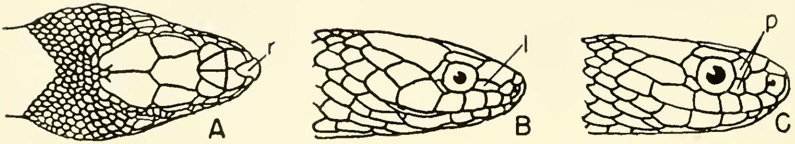


FIG. 157. A. Dorsal view of head of a bull snake, *Pituophis melanoleucus*, × ¾, from Cope (1900). B. Lateral view of head of a western ground snake, *Haldea valeriae*, approx. × 2, from Blanchard (1925). C. Lateral view of head of a red-bellied snake, *Storeria occipitomaculata*, × 2⅔, from Blanchard (1925); l, loreal; p, preocular; r, rostral.

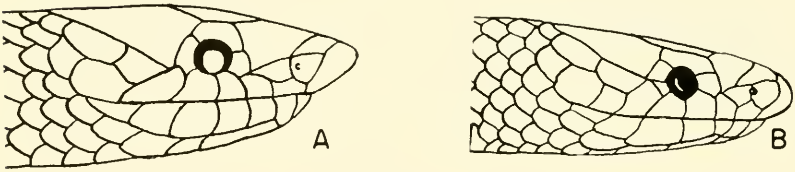


FIG. 158. A. Lateral view of a head of slender tantilla, *Tantilla gracilis*, × 4, 10 miles southwest of Somerset, Atascosa County, Texas. B. Lateral view of head of collared tantilla, *Tantilla atriceps*, × 4, Drumright, Oklahoma. After Taylor (1937).

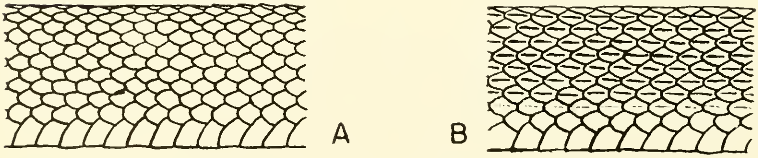


FIG. 159. A. Smooth scales as seen in side view of body, as of a king snake, *Lampropeltis*, × ⅘. B. Keeled scales as seen in side view of body, as of a water snake, *Natrix*, × ⅘. From Perkins (1940).

3′. Snout rounded, not keeled.

- 4. Entire dorsal surface uniformly dark except for a conspicuous, narrow, light ring around neck; belly yellowish, black-dotted. *Diadophis punctatus,* p. 224
- 4′. Ring on neck lacking, or if present the dorsal surface with other markings also.
  - 5. Color of entire dorsal surface black or dark brown, sharply differentiated, at third dorsal scale row, from unspotted yellowish or reddish color of belly; prefrontal touching eye . . . . *Carphophis amoenus,* p. 222
  - 5′. Color of dorsal or ventral surfaces marked with some sort of pattern, or else merging with each other gradually at sides of ventral scales; prefrontal touching or not touching eye.
    - 6. All or most subcaudals undivided. *Rhinocheilus lecontei,* p. 261
    - 6′. All or most subcaudals divided.
      - 7. Rostral twice as high as wide; usually four prefrontals (Fig. 157A) . . *Pituophis melanoleucus,* p. 250
      - 7′. Rostral nearly or fully as wide as high; two prefrontals.
        - 8. Preocular absent; prefrontal in contact with eye (Fig. 157B).
          - 9. Five supralabials; 1 postocular; usually 1 internasal . . . . *Haldea striatula,* p. 285
          - 9′. Six supralabials; 2 postoculars; 2 internasals (Fig. 157B) . . . . *Haldea valeriae,* p. 287
        - 8′. Preocular present; prefrontal not in contact with eye.
          - 9. Loreal absent (Fig. 157C).
            - 10. Scales smooth (Fig. 159A).
              - 11. Six supralabials (Fig. 158A); top of head sometimes darker than body but the colors of body and head merging gradually with each other . . . *Tantilla gracilis,* p. 265
              - 11′. Seven supralabials (Fig. 158B); top of head black, the color sharply distinguished from that of body; dark area on head with a V-shaped posterior border whose apex extends onto neck. *Tantilla nigriceps,* p. 268
            - 10′. Scales keeled (Fig. 159B).
              - 11. Seventeen scale rows; 7 supralabials . . . . *Storeria dekayi,* p. 281
              - 11′. Fifteen scale rows; 5 or 6 supralabials (Fig. 157C). *Storeria occipitomaculata,* p. 283
          - 9′. Loreal present.

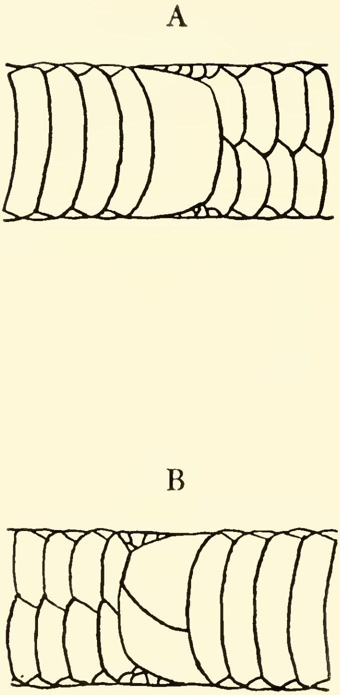


FIG. 160. Undivided anal plate, as of a king snake, *Lampropeltis*, × 1. B. Divided anal plate, as of a rat snake, *Elaphe guttata*, × 1. From Perkins (1940).

10. Anal plate undivided (Fig. 160A).

11. Dorsal scales keeled (Fig. 159B).

12. Two rows of black spots down middle of belly; supralabials 6 or less .... *Tropidoclonion lineatum,* p. 298

12′. Spots on belly, if in 2 rows, much nearer sides than middle of belly; supralabials 7 or more.

13. Lateral light stripe clearly involving third and fourth scale rows anteriorly.

14. Lips barred; tail less than 27 percent of total length; supralabials usually 7; fields between stripes with well defined spots ...... *Thamnophis radix,* p. 293

14′. Lips not barred; tail 27 percent or more of total length; supralabials usually 8; fields between stripes tending to be uniformly dark, the spots scarcely or not evident .... *Thamnophis sauritus,* p. 296

13′. Lateral light stripe absent, indistinct, or clearly not involving 4th scale row.

14. Lateral light stripe not involving second scale row on anterior half of body; scale rows at middle of body 21; lips prominently barred; a conspicuous, crescent-shaped white mark behind angle of jaw.
Thamnophis marcianus, p. 289

14′. Lateral light stripe involving second scale row on anterior half of body; scale rows at middle of body 19; lips slate-colored, feebly barred; no crescentic white mark behind angle of jaw.
Thamnophis ordinatus, p. 291

11′. Dorsal scales smooth (Fig. 159A).

12. No markings on belly; scale rows 29 or more.
Arizona elegans, p. 248

12′. Belly marked in some fashion; scale rows 27 or less.

13. Pattern consisting of red-centered blotches or rings.
Lampropeltis triangulum, p. 258

13′. Pattern not of red-centered blotches or rings.

14. Pattern consisting chiefly of a dorsal series of gray or brown, *black-edged* blotches on a lighter background; scale rows around middle of body usually 25 or 27 .... *Lampropeltis calligaster,* p. 253

14′. Dorsal pattern consisting chiefly of small, light (yellow) spots on a dark background, either irregularly and profusely scattered (one on nearly every scale), or fewer and outlining dark blotches; scale rows around middle of body usually 19 or 21.
Lampropeltis getulus, p. 256

10′. Anal plate divided (Fig. 160B).

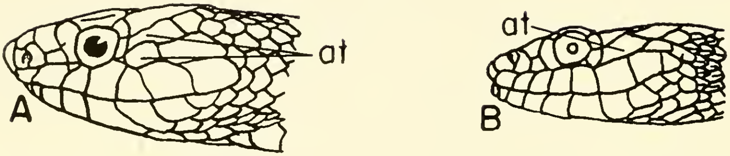


Fig. 161. A. Lateral view of head of a racer, *Coluber constrictor,* × ¾, from Blanchard (1925). B. Lateral view of head of a water snake, *Natrix erythrogaster,* × 1, from Cope (1900); at, anterior temperal.

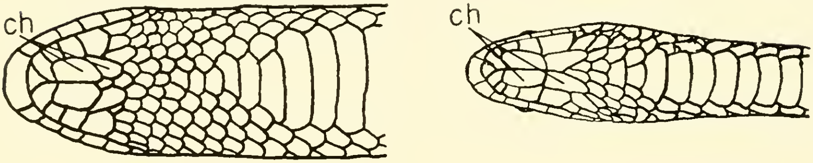


Fig. 162. A. Ventral view of head of a plains ground snake, *Sonora episcopa,* × 4. B. Ventral view of a smooth green snake, *Opheodrys vernalis,* × 2. From Schmidt and Davis (1941).

11. Two or more anterior temporals in contact with postocular (Fig. 161A).
12. Scale rows 25 or more.
13. A large ∧-shaped mark on head; apex of mark between eyes, and arms united with first blotch on neck. *Elaphe guttata*, p. 243
13′. No such mark on head, which is more or less unicolor above.
14. More than 220 ventrals . . . . *Elaphe obsoleta*, p. 245
14′. Fewer than 220 ventrals (not yet recorded from the state) . . . . *Elaphe vulpina*, p. 323
12′. Scale rows 17 or fewer.
13. Scale rows 15 immediately in front of anus. *Coluber constrictor*, p. 236
13′. Scale rows 13 immediately in front of anus. *Masticophis flagellum*, p. 240
11′. Only one anterior temporal in contact with postocular (Fig. 161B).
12. Scales smooth.
13. Posterior chinshields much shorter than anterior chinshields (Fig. 162A) . . . . *Sonora episcopa*, p. 263
13′. Posterior chinshields approximately as long as anterior chinshields (Fig. 162B).
14. Uniform green above . . . . *Opheodrys vernalis*, p. 234
14′. Numerous blotches present on back and sides. *Hypsiglena torquata*, p. 269
12′. Scales keeled.
13. Uniform green above, unmarked below; scale rows 17. *Opheodrys aestivus*, p. 231
13′. Not green above but instead usually blotched or striped; belly frequently marked; scale rows 19 or more.
14. Scale rows 19; striped . . . . *Natrix grahamii*, p. 274
14′. Scale rows 21 or more.
15. Belly without markings, or dark markings on only the anterior edges of belly scales; dorsal markings obscure in adults; 3 or fewer complete transverse bands on neck . . . . *Natrix erythrogaster*, p. 272
15′. Belly with definite markings; dorsal markings visible in all specimens; 5 or more complete transverse bands on neck.
16. Large dorsal spots, the anterior spots forming broad transverse bands . . *Natrix sipedon*, p. 279
16′. Small alternating, dorsal and lateral spots connected by oblique bars . . *Natrix rhombifera*, p. 276

FAMILY LEPTOTYPHLOPIDAE

Genus *Leptotyphlops* Fitzinger

New Mexican Blind Snake

Leptotyphlops myopica (Garman)

Stenostoma myopicum Garman, Mem. Mus. Comp. Zoöl., vol. 8, 1883, p. 6 (type locality—Tampico, Tamaulipas, Mexico).

Leptotyphlops myopica Barbour and Loveridge, Bull. Mus. Comp. Zoöl., vol. 69 (10), 1929, p. 345.

Range.—Southern midwest border of state; recorded from Meade (1 mile west of State Lake; 10 miles west of Englewood), Clark (2 miles south of State Lake; Stevenson Ranch); and Barber (Lake City) counties.

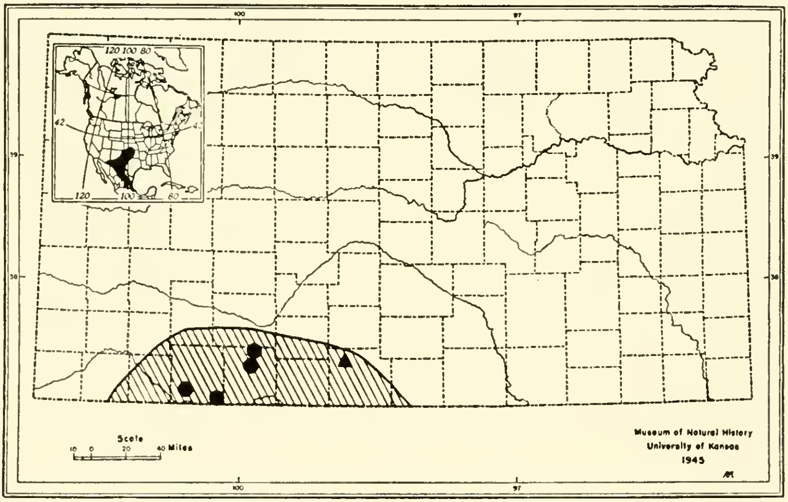


FIG. 163. Distribution of the New Mexican blind snake, *Leptotyphlops myopica,* in Kansas, with insert showing range of the species.

Description.—A slender, wormlike snake, cylindrical throughout its length; eyes not clearly visible, appearing as a dark spot on each side of head, underneath a large scale (ocular); a large rostral, followed middorsally by a series of scales little different from those on body, the anterior four, in order from front to back, known as prefrontal, supraocular, interparietal, and interoccipital; a supraocular on either side of prefrontal, in contact with ocular; two occipitals back of ocular, on each side, each in contact with middorsal series of scales, the first in contact with the last (third) supralabial and sometimes split into two, and the second separated from third supralabial by single temporal scale; a large nasal, divided crosswise through the naris into two scales, in front of ocular; upper lip bordered by rostral, nasal, 1st and 2nd supralabials, ocular, and third supralabial, in succession from anterior to posterior. All scales around body uniform in size and character, all smooth; fourteen scale rows around body, ten around tail near base; 224 to 246 (average 238) middorsal scales from rostral to spine at tip of tail; twelve to sixteen (average 14) midventral subcaudals from anus to terminal tail spine.

Dark above on seven scale rows (3 on either side of middorsal series), pink to cream below.

Size small, total length reaching 10¾ inches; ratio of total length to diameter of body averages 51 in adults, ratio of total length to tail length about 21.7.

Recognition Characters.—No other snake in Kansas has ventral scales which are no wider than the dorsals; in this species, all scales on the body, above and below, are of equal size; in other snakes of the state the ventral scales are several times as large as the dorsals.

Habits and Habitat.—Little has been recorded about this species. It lives in rocky, semi-arid areas where moisture may locally be present. It is a strange fact that moist spots are preferred, such as the ground underneath rocks and other surface cover, while the species does not occur in regions which receive much rainfall. Loose, sandy soil is preferred. In captivity moist sand is preferred to dry.

The snakes are nocturnal, emerging at about sunset and actively moving about for two hours or more; they are most active from 8:00 to 8:30 p. m.

They emerge only when temperatures at night are 64° F. or higher; optimum temperatures are between 78° and 82° F. They are most easily obtained by driving slowly along paved highways and watching the lighted part of the road.

In the daytime these snakes are most frequently found under stones, especially soon after heavy rains and as long as moisture remains.

The food probably consists of soft-bodied insects such as termites; ant eggs have been eaten in captivity. They drink as do other snakes, and use the tiny tongue for perception of odors.

Eggs are laid presumably in middle or late summer; as many as seven are laid by a single snake. Snakes as small as 7⅝ inches in total length are known to lay eggs. The eggs are long and slender, and in other species of about the same size and proportions measure approximately 15 × 4½ mm.

Nocturnal birds of prey, and some other predators, for example coyotes, are known to prey upon these snakes. When the snakes are forced to emerge in the daytime, as sometimes occurs in floods, diurnal birds and other animals readily feed upon them. These snakes are inoffensive and incapable of biting a person.

Kansan Subspecies.—Two races are here recognized (some authors recognize 3), only one of which is known in Kansas: *Leptotyphlops myopica dissecta* (Cope) whose type locality is Lake Valley, Sierra County, New Mexico. The other subspecies occurs in northeastern Mexico.

Reference.—Klauber, 1940:112-117, 144-149 (taxonomy and summary of life history).

FAMILY COLUBRIDAE

Genus *Carphophis* Gervais

Worm Snake

Carphophis amoenus (Say)

Coluber amoenus Say, Journ. Acad. Nat. Sci. Phila., vol. 4, pt. 2, 1825, p. 237 (type locality—Philadelphia, Pennsylvania).

Carphophis amoena Blanchard, Papers Mich. Acad. Nat. Sci., Arts Letters, vol. 4, 1924, p. 527.

Range.—Eastern third of the state. Recorded as far west as Riley (Garrison), Geary (5 miles southwest of Wreford), Chase (6 miles southwest of Cottonwood Falls), Greenwood (4 miles northwest of Lamont) and Cowley (13 miles east-northeast of Arkansas City) counties.

Description.—Head flat, no wider than neck; head scales typical (see Fig. 150) except as follows: supraocular small, of about the

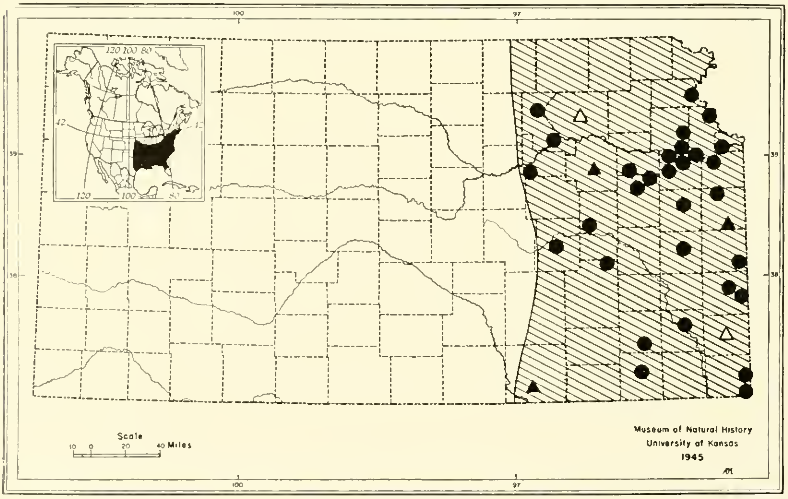


FIG. 164. Distribution of the worm snake, *Carphophis amoenus*, in Kansas, with insert showing range of the species.

same size as postocular; frontal large, pentagonal; nasal single; loreal touching eye; no preocular; one postocular; one anterior and one posterior temporal; five supralabials, last low, elongate; six infralabials. Scales on body absolutely smooth; dorsals in thirteen rows throughout length of body; anal and all subcaudals divided; ventrals 127-137 in males, 129-148 in females; subcaudals 37-41 in males, 23-33 in females.

Glossy black or brownish-black, salmon pink below; belly color extending dorsally onto the three lower dorsal scale rows.

Size small, reaching 12$^{13}/_{16}$ inches in total length; tail about one-seventh of total length.

Recognition Characters.—No other species of snake in the state has the dorsal surface uniformly black and the belly orange. Also this snake is the only one in Kansas having no more than thirteen scale rows. The only other species (2 of *Haldea*) that lack a preocular have keeled scales.

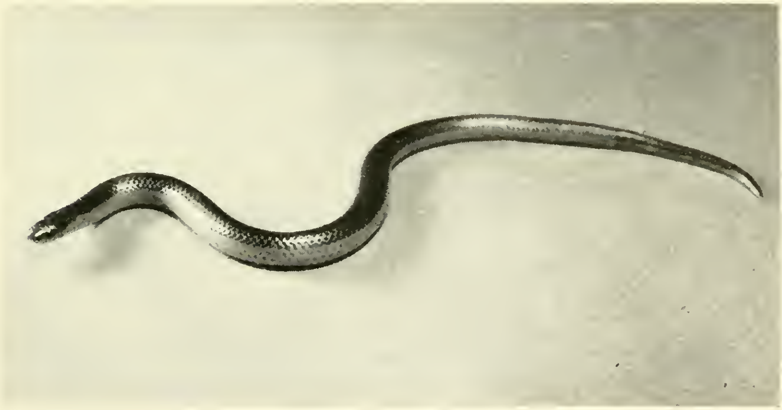


FIG. 165. A worm snake, *Carphophis amoenus vermis*, × ⅔, from Golden Eagle, Calhoun County, Illinois.

Habits and Habitat.—This species is commonly found in the eastern part of the state in moist woods under stones or logs. Probably it is nocturnal; I collected a specimen in Cherokee County at night as it crawled on the gravel banks of a creek. The food consists almost entirely of earthworms; the snake does not constrict its food.

Two to five eggs are laid in July. They measure approximately 30 × 10 mm. and hatch in September. The species is entirely innocuous and never attempts to bite persons.

Kansan Subspecies.—Three subspecies are recognized; one, *Carphophis amoenus vermis* (Kennicott), occurs in Kansas, and its type locality is in Missouri. The other races occur in the eastern United States.

Reference.—Blanchard, 1925:527-530 (taxonomy).

Genus *Diadophis* Baird and Girard

Eastern Ring-necked Snake

Diadophis punctatus (Linnaeus)

Coluber punctatus Linnaeus, Syst. Nat., ed. 12, vol. 1, 1766, p. 376 (type locality—Charleston, South Carolina).

Diadophis punctatus Baird and Girard, Cat. N. Amer. Rept., pt. 1, 1853, p. 112.

120 100 80
120
100
60

Range.—Probably state-wide, except perhaps the extreme northwestern quarter. Not recorded in the area north of Wallace (Wallace) and Gove counties, and west of Mitchell County.

Description.—Head flattened, a little broader than neck; head scales typical, as indicated in Fig. 150. Scales on body absolutely smooth, dorsals usually in seventeen scale rows on anterior two-thirds of body, fifteen on posterior one-third (sometimes 17-17, or 15-15, or 15-17-15); anal and all subcaudals divided; ventrals 142-169 (average 156) in males, and 151-185 (average 168) in females; subcaudals 37-57 (average 46) in males, and 30-50 (average 41) in females.

Slate grey to black above (on all dorsal scales), darker on head; an orange or yellow ring one or two scales wide across neck, bordered with black behind; supralabials, infralabials, chin and throat whitish, with small, scattered, black spots; belly usually with many, scattered black dots, rarely absent or arranged in a single midventral row, sometimes arranged in two rows; posterior lateral edge of sub-

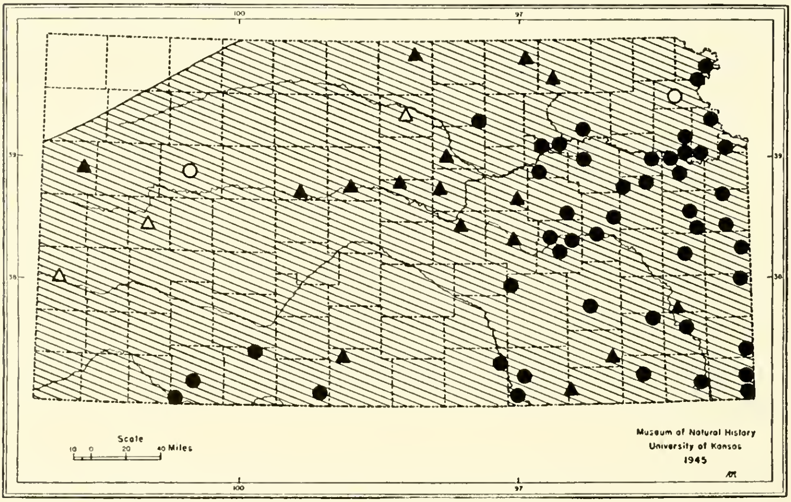


FIG. 166. Distribution of the eastern ring-necked snake, *Diadophis punctatus*, in Kansas.

caudals black, and to a lesser extent those of ventrals also; anterior part of belly whitish or pale pink, the latter color becoming more intense posteriorly, so that on the tail it is bright red.

Size small, total length reaching 15½ inches; tail varies from 12.5 to 22 percent of total length; newly hatched specimens measure four inches in total length.

Recognition Characters.—The presence of a narrow, light ring across the neck above—the only marking on the otherwise uniformly dark back—is absolutely distinctive, among Kansan species.

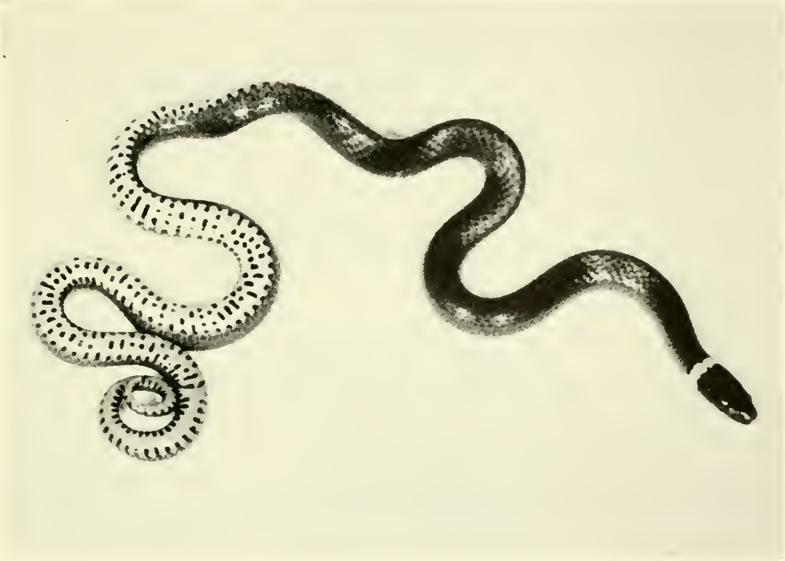


FIG. 167. An eastern ring-necked snake, *Diadophis punctatus arnyi*, × 1, from Tarrant County, Texas. Courtesy Louis W. Ramsey.

Habits and Habitat.—In eastern Kansas this species is commonly found in more or less open woods, under stones, and in or under rotten logs and stumps. Ordinarily it is found on hillsides rather than on flat land, perhaps because of the greater amount of cover. Piles of drift sometimes harbor the species which probably is nocturnal.

The food consists of earthworms and, in captivity, small salamanders. Insect eggs and insects such as beetles also are eaten. There are some records of small snakes, frogs, and lizards having been eaten. The food is not constricted.

The eggs vary from one to three from each female, and are laid from June to August in rotten logs and in the ground. They measure approximately 27 × 6.5 mm. and hatch in from fifty-four to seventy days. In the first year an increase of sixty-seven percent in length of the snake is recorded, and for successive years increases of thirty-six, thirty-one and nine percent.

When captured, these snakes have a habit of curling the tail in a spiral, with the bright red underside uppermost, and at the same time they void excreta and secretions from the anal scent glands. The odor produced is rather offensive. Ordinarily this reaction is not repeated after the snake is first handled.

Kansan Subspecies.—Five subspecies are recognized. One, *Diadophis punctatus arnyi* Kennicott, whose type locality is Hyatt, Anderson County, Kansas, is known from the state. The other subspecies occur in the eastern part of the United States as far west as Texas.

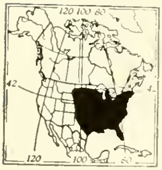
Reference.—Blanchard, 1942:69-87, fig. 16 (monograph).

Genus *Heterodon* Latreille

Common Hog-nosed Snake

Heterodon platyrhinos Latreille

Heterodon platyrhinos Latreille, Hist. Nat. des Rept., vol. 4, 1800, p. 32, figs. 1-3 (type locality—Philadelphia, Pennsylvania).



Range.—State-wide. Not yet recorded from either the extreme northwestern or extreme northeastern corner but certainly occurring in the latter and probably also in the former part of the state.

Description.—Snout (the rostral scale) projecting forward, with a single median keel above, not turned up; one or two small unpaired scales immediately back of rostral, separating prefrontals; nasal divided; a ring of seven to thirteen small scales surrounding eye, except above it where the supraocular is situated; generally one, sometimes two loreals; two to four anterior temporals; two large temporal scales bordering last three supralabials; supralabials generally eight, infralabials generally ten; head scales otherwise about as usual (as in Fig. 150). Dorsal scales keeled except in one to three rows next to ventrals; scale rows twenty-five or twenty-seven anteriorly, twenty-three or twenty-five at middle of body, and usually nineteen (seldom 17) in front of anus; anal and all subcaudals divided; ventrals 122-139 in males, 122-147 in females; subcaudals 45-57 in males, 40-52 in females. One or two teeth somewhat enlarged at rear of the upper jaw, but solid and fixed in position, and lacking in any function concerned with venom.

Ground color yellow to dark gray; except in darkest specimens in which the pattern is little evident, a series of 20-31 rather large, dark blotches on middle of back (excluding tail); a series of smaller dark blotches on either side, alternating with dorsal blotches; ground color frequently lighter between median dark blotches; tail with seven to fourteen alternating dark and light rings above. Belly yellowish to gray, with vague, indefinite and irregular dark areas toward sides (darker in young specimens, becoming almost entirely black); undersides of head, throat and tail usually lighter than rest of ventral surfaces.

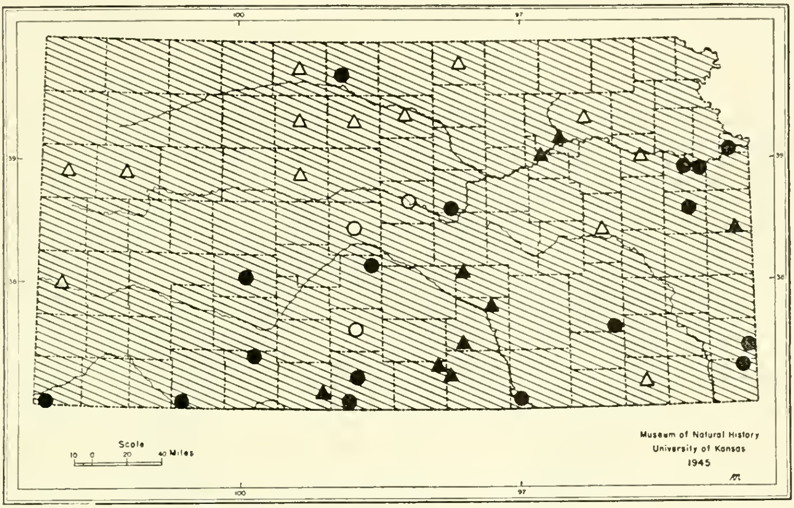


FIG. 168. Distribution of the common hog-nosed snake, *Heterodon platyrhinos*, in Kansas.

Total length reaching thirty-nine inches; tail fourteen to twenty-three percent of total length.

Recognition Characters.—The shovellike tip of the snout, with the upper edge *horizontal* (not turned up), is distinctive. No other species, except *H. nasicus*, has a similar, shovellike snout, but the upper edge (as seen in lateral profile) turns sharply upward. These two species are the only ones in the state with a median, dorsal longitudinal ridge on the rostral plate.

Habits and Habitat.—Dry areas where ample sunshine reaches the ground seem to be required for this species. Specimens are to be found in dry woods, on sandy shores of rivers, in sand dunes, but seldom in moist or heavily wooded areas.

The food consists almost exclusively of toads, but frogs are eaten, and at times insects. Birds have been recorded. The food is not constricted.

Mating occurs in April and May. Eight to forty eggs are laid in June or July, and hatch sixty to ninety days later, as late as the middle of October. Emergence from hibernation occurs as early as late January in Ohio, but probably not before March in Kansas.

These snakes are diurnal in habit. Their most widely known habit is that of flattening the head and much of the body when disturbed. Upon discovery this is their immediate reaction; continued disturbance will cause the snake to act more threateningly, jerkily thrusting the head outward, twisting the tail, and voiding excreta and secretions from the anal scent glands. The mouth may be held partly open, while the snake hisses ferociously. The strikes and fierce demeanor are, however, all bluff, for these snakes, even in their worst moods, practically never bite persons. If the bluff does not drive the tormentor away, the snake rolls over onto its back, twitches a little, opens the mouth, which may be somewhat bloody inside, and holds the tongue extended in an arch forward and downward from the lower jaw. Even though the snake is picked up, and otherwise molested, it will remain limp as though dead. If the intruder leaves, the snake gradually regains confidence, and after a cautious survey of its environs rolls onto its belly and crawls away. Reappearance of danger may cause the snake to flop again onto its back, but this behavior is not repeated many times. After a few hours the snake tires of the sham and cannot afterward be induced to perform under any circumstances.

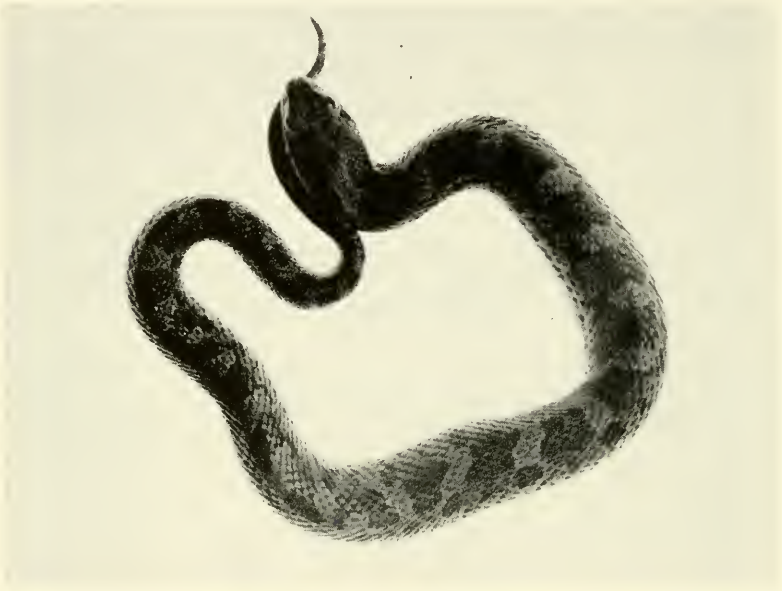


FIG. 169. A common hog-nosed snake, *Heterodon p. platyrhinos*, × 1/3, Shawnee National Park, Illinois. Photo by R. R. Hamm.

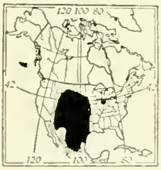
Kansan Subspecies.—Two subspecies are currently recognized; one, *Heterodon platyrhinos platyrhinos* (Latreille) occurs in Kansas. The other subspecies occurs in Florida. This species has been known erroneously for the past 30 years as *Heterodon contortrix.*

References.—Cope, 1900: 761-769, figs. 165, 166 (description, habits); Conant, 1938: 41-44 (description, habits, Ohio); McCauley, 1945: 63-66 (description, habits, Maryland); Schmidt and Davis, 1941: 115, 117-118, figs. 25, 26, pl. 11 (description, habits).

Western Hog-nosed Snake

Heterodon nasicus Baird and Girard

Heterodon nasicus Baird and Girard, Stansbury's Expl. Surv. Valley Great Salt Lake, 1852, p. 352 (type locality—Amarillo, Texas).



Range.—Entire state except extreme southeastern corner, in Ozark Plateau region. Not recorded from northeastern corner but to be expected. Peripheral records towards the east are in Washington (4 miles north of Haddam), Riley (Manhattan), Douglas, Franklin, and Crawford (1 mile east of Arma) counties.

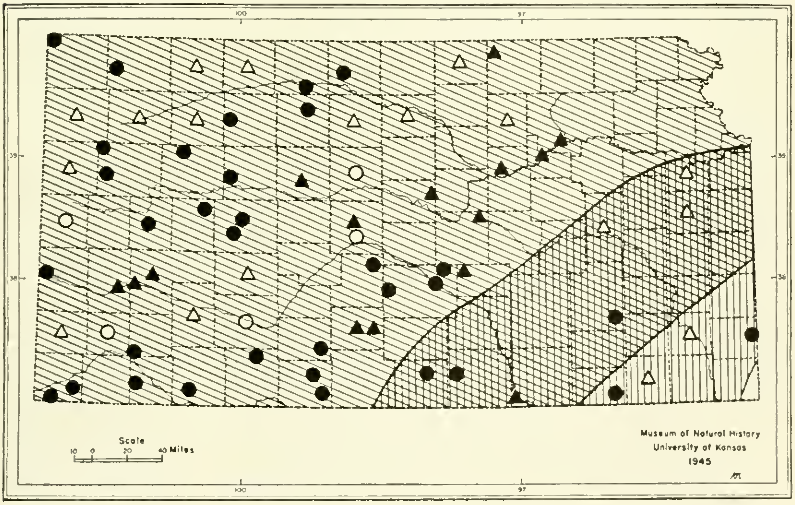


FIG. 170. Distribution of the western hog-nosed snake, *Heterodon nasicus*, in Kansas. The range of *H. n. nasicus* is indicated by oblique lines, that of *H. n. gloydi* by vertical lines. Area of overlap of lines indicates zone of intergradation.

Description.—Snout (the rostral scale) projecting forward, with a single median keel above, rather sharply turned up; 9 to 25 small scales between rostral and large plates above and between eyes (frontal, supraoculars); nasal divided; a ring of 9 to 13 small scales encircling eye, except above where supraocular is situated; 1 to 6 lo-

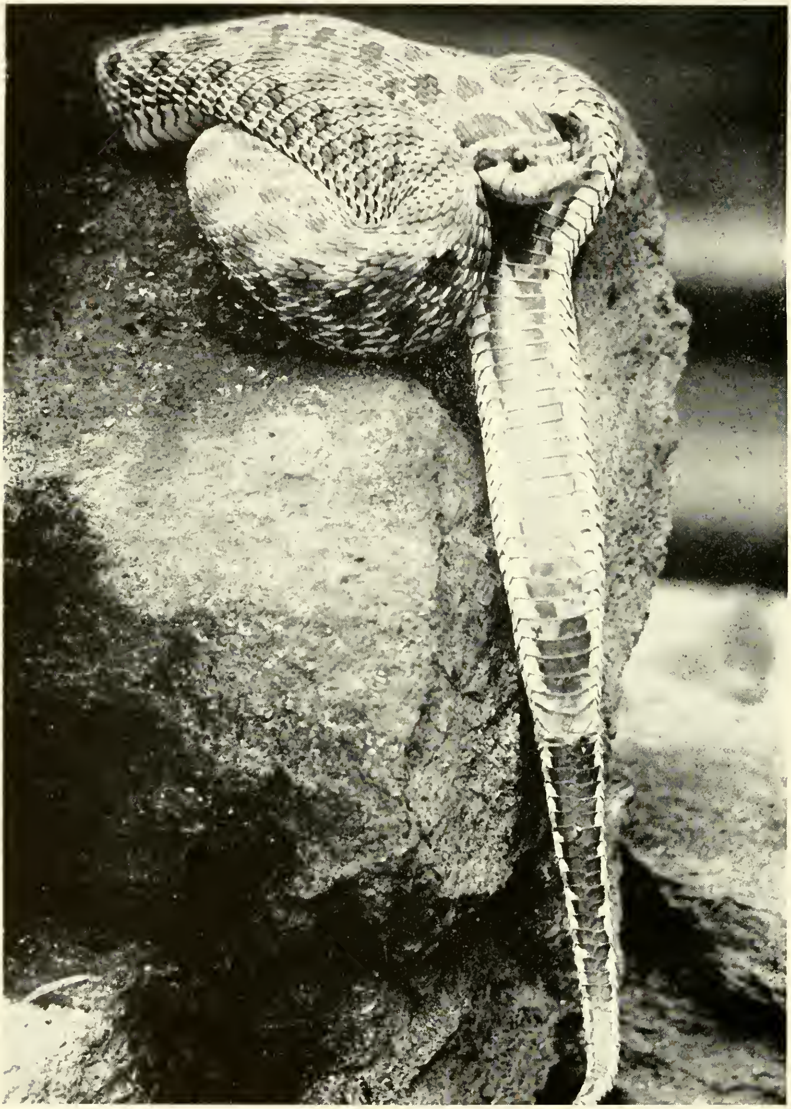


FIG. 171. A western hog-nosed snake, *Heterodon nasicus gloydi,* approx. × ⅗. Courtesy of the New York Zoölogical Society.

reals; 3 or 4 anterior temporals, the lower largest; supralabials unusually high, generally 8; infralabials 10 or 11; anal and all subcaudals divided; head scales otherwise about as usual (as in Fig. 150). Dorsal scales keeled except in one row next to ventrals; scale rows 20-26 anteriorly, 21-24 at middle of body, and 17-20 in front of anus; ventrals 128 to 141 in males, 139-151 in females; subcaudals 41-47 in males, 32-38 in females.

"Ground color above light yellowish-brown; a median dorsal row of 31-50 (av. 40.1) dark brown or olive blotches; 2 or 3 rows of small alternating blotches along each side (often obscure except the upper row); scales between median dorsal blotches sometimes pale brownish-white, forming narrow cross-bars; ventral surface yellowish-white with wide irregular black band down center; this black band usually interrupted by blotches of white or yellow." (Hudson, 1942:51.)

Size moderate, total length reaching 26½ inches; tail about 15 percent of total length.

Recognition Characters.—See discussion of *H. platyrhinos.*

Habits and Habitat.—This species inhabits only relatively dry areas, and is especially abundant in sand dunes. It is characteristic of prairie regions. The food apparently is much the same as that of *H. platyrhinos,* consisting chiefly of toads. It is not constricted. Like all other hog-nosed snakes, this species shams death, in much the same manner as described in the discussion of *H. platyrhinos.* It is diurnal and egg-laying.

Kansan Subspecies.—Three subspecies are known, two of which, *Heterodon nasicus nasicus* Baird and Girard, and *H. n. gloydi* Edgren, with a type locality at Wheelock, Robertson County, Texas, occur in this state. The other occurs in the Rio Grande Valley of Texas and in northern Mexico. In *H. n. nasicus* and *H. n. gloydi* respectively the middorsal blotches on body are 35 or more *vs.* 32 or fewer in males; in females they are 40 or more *vs.* 37 or fewer.

References.—Cope, 1900: 774-777, fig. 168 (description, variation); Edgren, 1952: 2-3 (taxonomy).

Genus *Opheodrys* Fitzinger

Rough Green Snake

Opheodrys aestivus (Linnaeus)

Coluber aestivus Linnaeus, Syst. Nat., ed. 12, vol. 1, 1766, p. 387 (type locality—Charleston, South Carolina).
Opheodrys aestivus Cope, Proc. Acad. Nat. Sci. Phila., 1860, p. 560.

Range.—Southeastern quarter of the state. Recorded as far west as Riley and Cowley (Arkansas City) counties. The record for Barton County (Great Bend) is questionable.

Description.—Head rather thick, a little wider than neck; head scales typical (see Fig. 150) except as follows: nasal single; one preocular; two posterior temporals; generally 7 supralabials, generally 8 infralabials. Scales on body keeled except those on outer 1 to 3 rows on each side, next to ventrals; 17 scale rows on anterior two-thirds of body, 15 on posterior third; anal and all subcaudals divided; ventrals 146 to 164, with little difference between the extreme counts of males and females; subcaudals 114 to 142, av. 128.

Dorsal color pale to dark green, unmarked; chin and throat pale yellow; other ventral surfaces yellowish white.

Body form extremely elongate and slender; total length reaching 32⅜ inches; tail varies from 34.6 to 41.8 percent of total length.

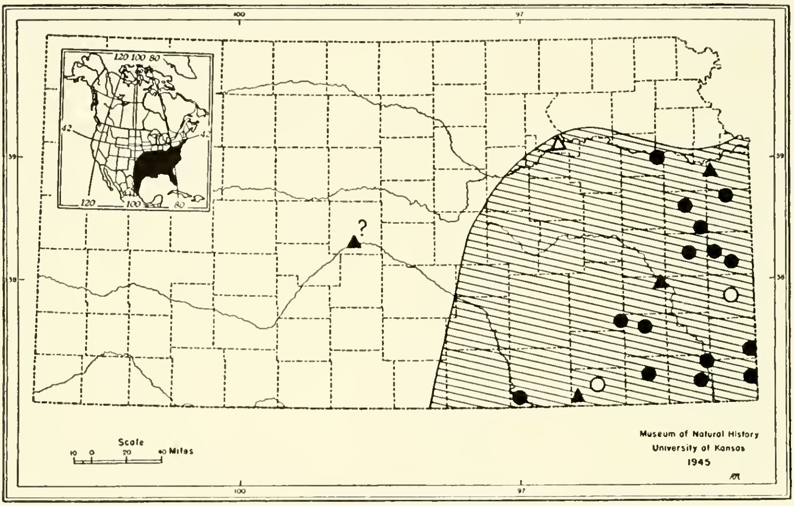


FIG. 172. Distribution of the rough green snake, *Opheodrys aestivus*, in Kansas, with insert showing range of the species.

Recognition Characters.—The keeled scales furnish an important character in this species, separating it from all others which are uniform bluish above and unmarked below. Most frequently confused, probably, are the smooth green snake and blue racer, both of which have absolutely smooth scales.

Habits and Habitat.—Open woods, fields and marshes are favorite haunts of this species. It occurs both on the ground and in bushes and low trees. In either place it is difficult to see because of the protective, green color. The snakes are often passed, as they rest without moving where they lie, stationary in position until a person reaches within a few inches of them. This habit of "freezing" in position renders them extremely difficult to detect. They lie for considerable periods with the head and a few inches of the neck extending upward, free from any support.

These snakes are nonpoisonous, but may attempt to bite when first captured. After a short time in captivity they are remarkably docile. Always they retain a degree of wiriness which does not make them as pleasant to handle as some other snakes. They are capable of extending the body outward an extraordinary distance. The tail has strong prehensile powers, although the body shows no ability to constrict. The snakes are completely diurnal.

The food consists mostly of insects, of which a large portion is grasshoppers; snails, flies, caterpillars and crickets have been recorded as the food of some specimens. In captivity they readily eat grasshoppers and crickets.

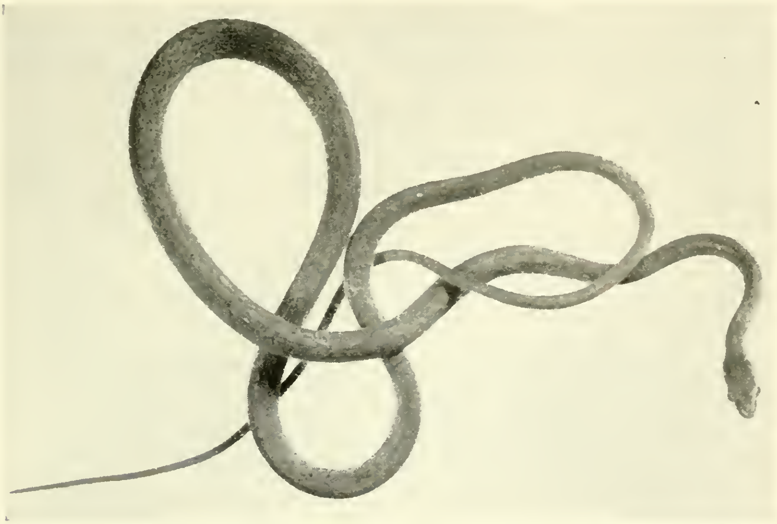


FIG. 173. A rough green snake, *Opheodrys aestivus majalis*. × ½, K. U. no. 23687, 3 miles north of Galena, Cherokee County, Kansas. Photo by Mrs. Virginia C. Unruh and T. P. Lyle.

Mating activities have been observed in the middle of May. One male of this species attempted to mate with a female of the smooth green snake.

The eggs are laid at any time in July in clutches of 3 to 9 in rotten stumps and logs. They measure 21-31 mm. in length and 10-12 mm. in width. They hatch in 56 to 62 days; the young average 200 (190 to 213) mm. in total length upon hatching and are dull grayish olive. In six days the skin is shed for the first time, and the color becomes bright, dark green.

Kansan Subspecies.—Opheodrys a. majalis (Baird and Girard), with type locality at New Braunfels, Comal County, Texas, is the subspecies occurring in Kansas. Two others are recognized in the eastern United States.

References.—Conant, 1938: 45-47, pl. 5, fig. 3 (description, natural history, Ohio); McCauley, 1945: 66-71, fig. 14 (description, natural history, Maryland); Burger, 1947 (abstract or taxonomic study, first modern usage of *o. a. majalis*, resurrected).

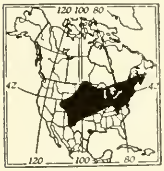
Smooth Green Snake

Opheodrys vernalis (Harlan)

Coluber vernalis Harlan, Journ. Acad. Nat. Sci. Phila., vol. 5, 1827, p. 361 (type locality—Philadelphia, Pennsylvania).

Opheodrys vernalis Schmidt and Necker, Herpetologica, vol. 1, no. 2, 1936, p. 64.

Range.—Not well known, but probably state-wide. The present records are all in the eastern third of the state or on the central southern border, but records from adjacent states indicate occurrence throughout all of Kansas. The great rarity of the species accounts for the paucity of data. Peripheral records are in Geary (Fort Riley), Riley (Manhattan), Pottawatomie, Douglas, Franklin (8 miles southeast of Ottawa), Crawford (Pittsburg), Montgomery, Chautauqua (4½ miles southeast of Cedar Vale), and Meade (Meade) counties.



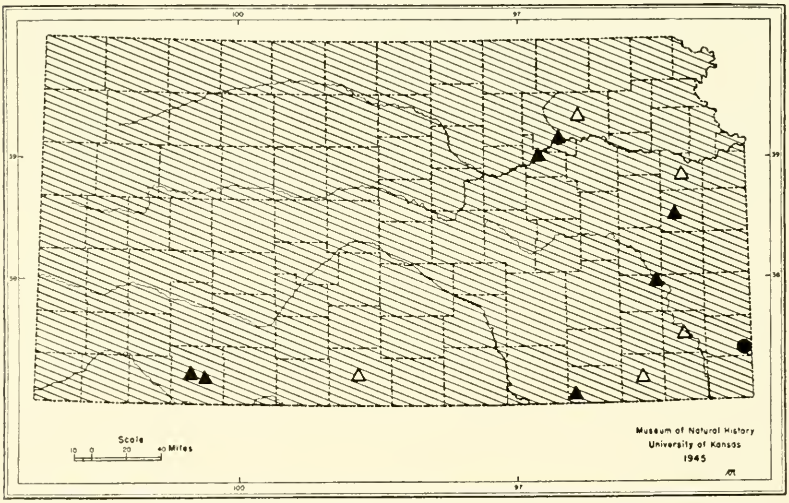


FIG. 174. Distribution of the smooth green snake, *Opheodrys vernalis*, in Kansas.

Description.—Head rather thick, elongate, a little wider than neck; head scales typical (see Fig. 150) except as follows: nasal entire; preocular generally single, occasionally double (28½ percent of specimens); two posterior temporals; generally seven supralabials; generally eight infralabials; internasals as large as prefrontals. Scales on body absolutely smooth; scale rows fifteen throughout length of body; anal and all subcaudals divided; ventrals 125-141 in males (average 134), 139-154 in females (average 145);

subcaudals 78-95 in males (average 88), 68-82 in females (average 75).

Dark greenish blue or blue above, without markings; ventral surface ivory yellow.

Slender and elongate in form; total length moderate, reaching 47⅝ inches; tail about twenty-five percent of total length.

Recognition Characters.—The bluish dorsal color, combined with the presence of no more than fifteen scale rows, is distinctive of this species in Kansas. Only four other species have fifteen and no more than fifteen scale rows on the body: *Sonora episcopa, Storeria occipitomaculata, Tantilla gracilis* and *T. nigriceps.* The latter three lack a loreal (present in *O. vernalis*) and *Sonora episcopa* has postgenials which are much shorter than the pregenials (equal in *O. vernalis*).

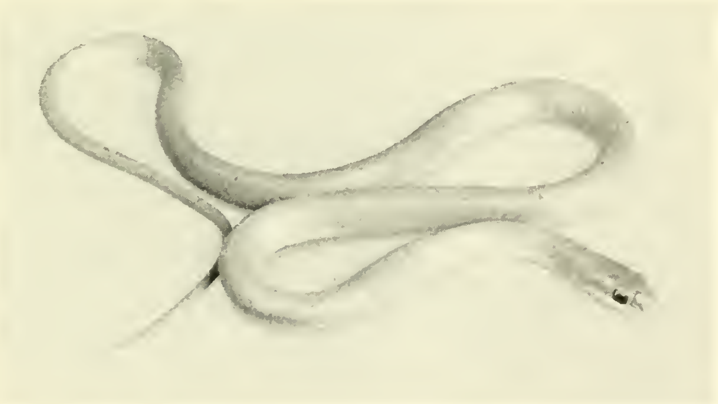


FIG. 175. A smooth green snake, *Opheodrys v. vernalis,* × ½, Durham, New Hampshire. Courtesy H. K. Gloyd.

Habits and Habitat.—This snake is found in relatively moist, grassy situations. Sometimes it climbs bushes. In most parts of its range it can be found under objects on the ground more readily than elsewhere, since in the open its coloration conceals it almost perfectly. It is diurnal.

The food consists chiefly of insects, including moths, crickets, beetles, ants and grasshoppers; other arthropods such as spiders are eaten, and snails also are taken; there is a record of one having eaten a salamander. In captivity crickets are said to be eaten freely. Lepidopterous larvae (caterpillars) also are readily taken, if the proper, hairless, green varieties are offered. It is possible that when available these actually form a large part of the diet in nature. The food is not constricted.

The life history of the race occurring in Kansas is unknown. The eastern race is known to lay three to eleven (usually 7) cylindrical eggs measuring 19.5 to 34 mm. in length and 8 to 18 mm. in width. The eggs are laid from late July to the end of August, and hatch in four to twenty-three days. The short incubation period is remarkable; the young snakes are well developed when the eggs are laid, measuring as much as 95 mm. in total length; at hatching the total length varies from 101 to 166 mm.

Mating has been recorded in the fall (August 18 and 22) in Ontario.

This snake is remarkably inoffensive, refusing to bite and quickly becoming calm and quiet in captivity.

Kansan Subspecies.—Two races are known, one of which, *Opheodrys vernalis blanchardi* Grobman, with type locality at Spanish Peaks, 8,000 ft., Colorado, occurs in Kansas. The other race occurs in the northeastern United States.

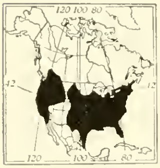
References.—Conant, 1938: 47-49 (description, summary of natural history, Ohio); Grobman, 1941: 1-38 (description, variation, taxonomy); McCauley, 1945: 71-73 (description, natural history, Maryland); Stille, 1954: 1-11 (reproduction, distribution).

Genus *Coluber* Linnaeus

Racer

Coluber constrictor Linnaeus

Coluber constrictor Linnaeus, Syst. Nat., ed. 10, vol. 1, 1758, p. 216 (type locality—northern America).



Range.—State-wide.

Description.—Head thick, elongate; head scales typical (see Fig. 150) except as follows: frontal nearly twice as wide anteriorly as posteriorly; two preoculars, the lower small; two anterior as well as two posterior temporals; supralabials generally seven, lower labials generally nine. Scales on body absolutely smooth; seventeen scale rows on anterior two-thirds of body, fifteen on posterior one-third; anal and all subcaudals divided; in both sexes ventrals 158 to 191 in the subspecies which occurs in Kansas (but in Kansas proper probably not less than 165), averaging about three less in males than in females (about 177 and 180 respectively, in Kansas); subcaudals 66 to 105 in both sexes throughout the range of the Kansas race (probably not less than 70, nor more than 95 in Kansas proper) averaging about seven more in males than in females (about 87 and 81, respectively, in Kansas).

This species goes through as remarkable a change in pattern from young to adult as any snake in the state. In the young "there is a median dorsal row of chestnut blotches which number 65-80 between the head and the anterior third of the tail. . . . Along either side and on the belly are numerous chestnut or blackish dots. The juvenile color pattern is well-developed in specimens up to sixteen inches in length, but gradually fades out beyond this so that in individuals twenty-one inches long the spots are barely visible." (Hudson, 1942:55.) The adults are pale greenish olive above and whitish to yellow below, without markings.

Size rather large, the total length reaching seventy-one inches in Ohio, and forty-seven and nine-sixteenths inches in Nebraska. The tail comprises 20-29 percent of the total length.

Recognition Characters.—The adults can be distinguished from all other Kansan snakes by the uniform bluish color of the upper parts combined with the occurrence of seventeen scale rows and absolutely smooth dorsals. Most often confused are the green snakes, one of which (*O. aestivus*) has keeled scales, while the other (*O. vernalis*) has fifteen scale rows.

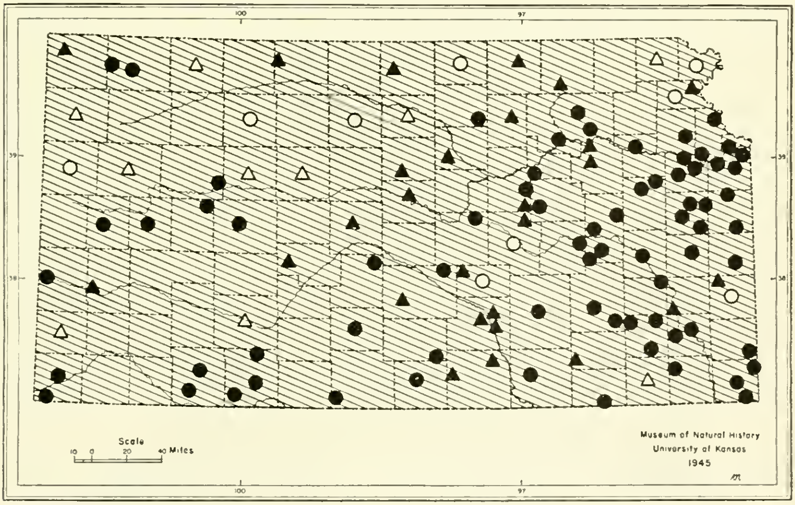


FIG. 176. Distribution of the racer, *Coluber constrictor*, in Kansas.

The spotted young could be confused with several other snakes, but the combination of smooth scales and seventeen scale rows will distinguish them from all other species of spotted snakes in the state.

Habits and Habitat.—This is one of the most ubiquitous snakes of the state, occurring in moist and dry habitats, in wooded areas and in prairies. Although it is chiefly a ground snake, it has been known to climb bushes and trees, and one author states that it ascends twenty to thirty feet into trees. It is commonly found along roads, but is most easily captured early in the morning before the sun has had a chance to warm the earth, under stones or other shelter where it spends the night. The snake is completely diurnal. During most of the day, unless the temperatures are low, it is not to be found under cover. When disturbed it flees rapidly, relying upon speed for escape, but if closely pursued it may stop abruptly and coil as tightly as possible.

The food is of enormous variety. Insects, especially the larger kinds, are commonly eaten; so also are smaller vertebrates such as lizards, other snakes, small mammals, birds, eggs of various vertebrates, frogs and toads. The animals eaten mostly have no economic value; the chief portions of the diet are kinds of animals which man regards as his competitors or as of no economic value. Racers eat copperheads and even other racers. Racers frequently hibernate with copperheads and rattlesnakes, sometimes in large numbers. The food is not constricted although the body may be used to hold the food down while the snake obtains a hold with its jaws.

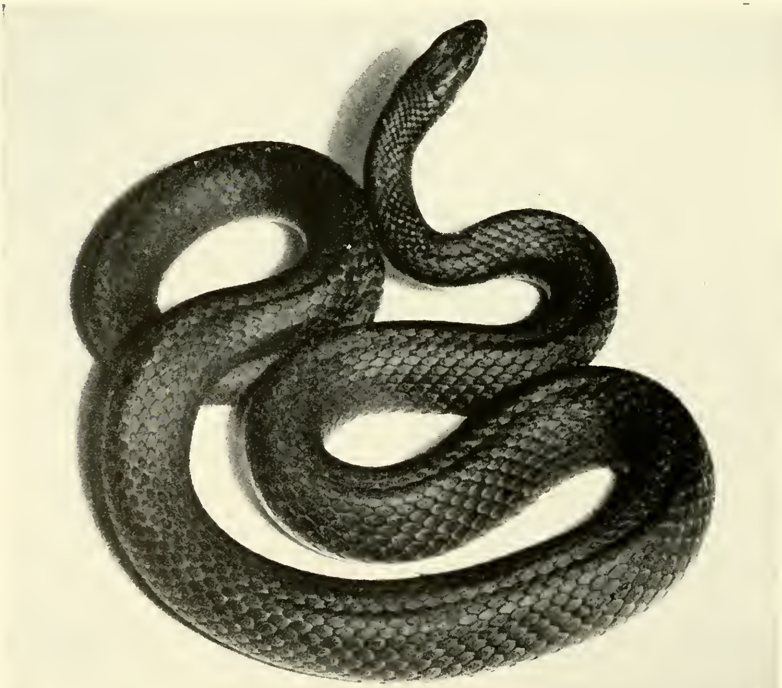


FIG. 177. An adult blue racer, *Coluber constrictor flaviventris*, × ⅓, K. U. no. 24391, 2 miles east of Shaw, Neosho County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Eight to twenty-five eggs are laid in June and July. They average 35 × 22 mm. in size, and are laid in the ground, in rotten logs and stumps, or in other debris of similar nature. They hatch in about two months (61, 62, 67 and 70 days have been recorded for the eastern subspecies, *C. c. constrictor*). Emergence from hibernation has been recorded in April.

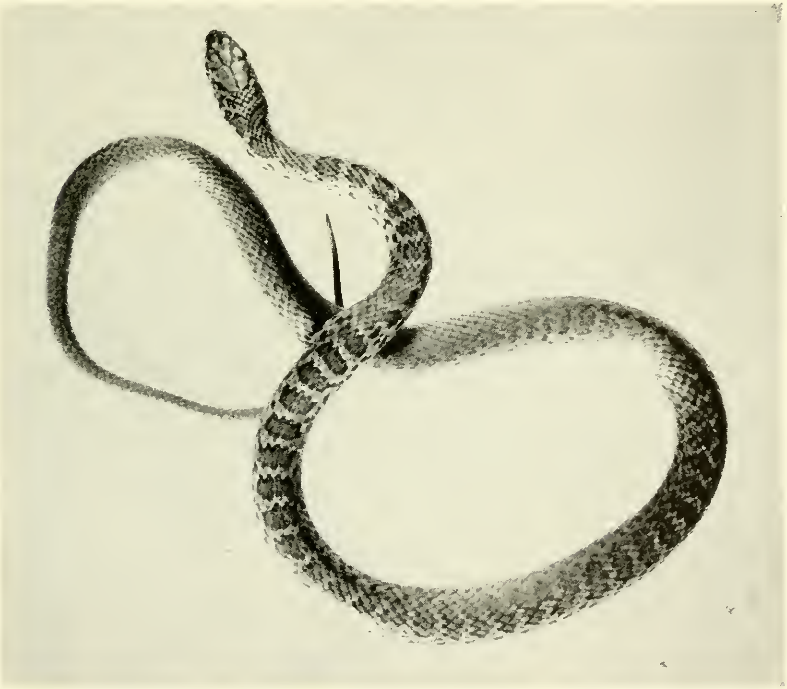


FIG. 178. A juvenal blue racer, *Coluber constrictor flaviventris*, × 1, 9 miles southwest of Clinton, Douglas County, Kansas. Photo by R. R. Hamm.

These snakes appear to have definite home territories and retreats to which they will return almost invariably, even though the intruder may stand between them and the retreat. When captured they are vicious, biting vigorously with a sliding motion that imbeds and tears the teeth through the flesh. They may become fairly tame in captivity, but are always nervous.

Kansan Subspecies.—In the United States and northern Mexico, six subspecies are known, of which only one occurs in Kansas. It is *Coluber constrictor flaviventris* Say, with type locality at a stone quarry on the west side of the Missouri River three miles above the mouth of Boyer's River, Iowa.

References.—Conant, 1938: 54-55 (description, variation, natural history, Ohio); Ortenburger, 1928: 175-192, pls. 27-30 (monograph).

Genus *Masticophis* Baird and Girard

Coachwhip

Masticophis flagellum (Shaw)

Coluber flagellum Shaw, Gen. Zoöl., vol. 3, 1802, p. 475 (type locality—Charleston, South Carolina).

Masticophis flagellum Ortenburger, Mem. Mus. Zoöl. Univ. Mich., vol. 1, 1928, p. 104.

Range.—State-wide except in the northeastern quarter. Peripheral localities in the north are in Rooks (Stockton), Ellis, Chase (Elmdale), Greenwood (Hamilton), Elk (5 miles west of Grenola), and Douglas counties. The latter is highly questionable.

Description.—Head thick, elongate; head scales typical (see Fig. 150) except as follows: frontal nearly twice as wide anteriorly as posteriorly; two preoculars, the lower small; two anterior as well as two posterior temporals; supralabials generally eight, infralabials generally ten, often eleven. Scales on body absolutely smooth; seventeen scale rows on anterior three-fifths of body, and thirteen immediately in front of anus; anal and all subcaudals divided; ventrals 186-207; subcaudals 94-119.

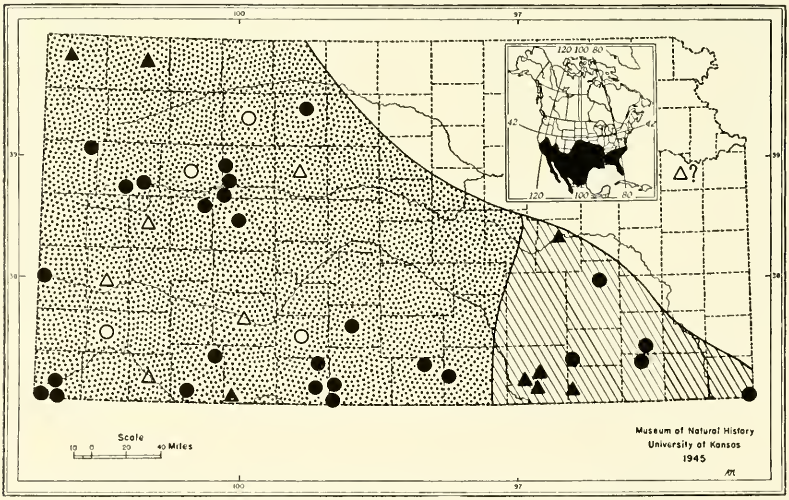


FIG. 179. Distribution of the coachwhip, *Masticophis flagellum*, in Kansas, with insert showing range of the species. The parallel lines indicate the range of *M. f. flagellum*, the dots that of *M. f. flavigularis*.

As in *Coluber*, the young of *Masticophis* are colored differently than the adults, although there is less difference in this genus than in *Coluber*. In the young the ground color is light brownish yellow; narrow, irregular-edged, dark brown crossbands are present anteriorly. Posteriorly these bands become dim and disappear on the posterior part of the body near the anus. The spaces between the bands are about equal to three times the width of the bands themselves. The belly is whitish or cream, anteriorly with a row of small dark spots on either side of the midventral line; these spots become dim as the rows extend posteriorly, and disappear on the posterior part of the belly. The head is irregularly marked with dark and light areas. In adults the dark bands become obscure, either by fading to the same color as the ground color, or by the darkening of the ground color to an intensity equal to that of the bands. As a result the adults are either uniform light brown above, with a double row of feebly defined spots below on an otherwise unmarked belly (*M. f. flavigularis*), or are black or dark brown above and below on the forepart of the body, light brown (mottled) above and whitish below on the rear part and on tail (*M. f. flagellum*).

The total length reaches six feet; the tail averages twenty-five percent of the total length. Elsewhere the species is recorded to reach eight feet two inches, less an estimated four-inch tail-tip.

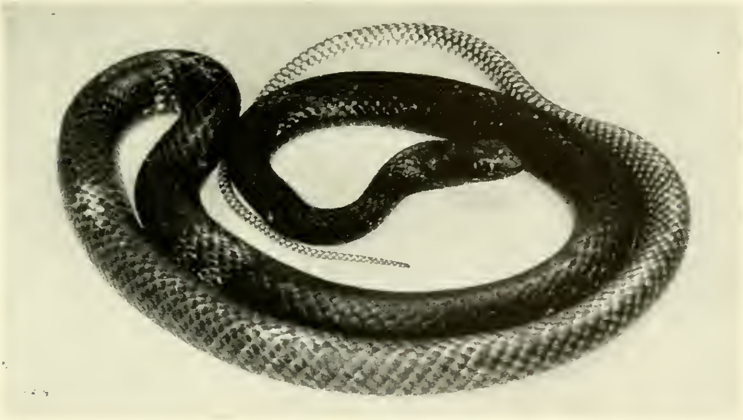


FIG. 180. An adult coachwhip, *Masticophis f. flagellum*, × ¼. Montgomery County, Texas. Photo by H. K. Gloyd.

Recognition Characters.—The smooth scales in 17 rows, reduced to 13 rows immediately in front of anus, is diagnostic of this species in Kansas. In body form the species resembles the blue racer, but no species is often confused with the coachwhip.

Habits and Habitat.—This terrestrial species usually is found in grassy areas more or less devoid of trees, but individuals are capable of climbing into trees and bushes. They are completely diurnal.

When captured these snakes ordinarily bite viciously, and the habit of rasping the long teeth through the flesh makes a painful wound. The tail frequently is vibrated when the snake is annoyed. The snakes are, nevertheless, nonpoisonous. Captives tame slowly.

The food consists of other vertebrates such as snakes, lizards,

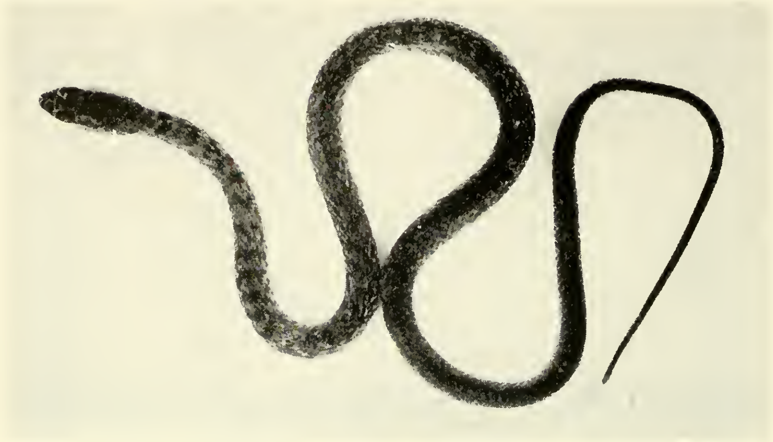


FIG. 181. A juvenal coachwhip, *Masticophis f. flagellum*, × 1, 8 miles east of Baxter Springs, Cherokee County, Kansas. Photo by W. W. Tanner and T. P. Lyle.

small mammals, and probably birds, and larger insects such as grasshoppers and cicadas. Large quantities of the latter are eaten where they are abundant. The food, if of considerable size, is commonly held down with the body as it is being swallowed, but the snake does not constrict. Occasionally other snakes are killed before being swallowed. The coachwhip grasps the head in its jaws and holds down the body with its own body; the coachwhip then rasps its teeth through the flesh back of the victim's head, producing a wound that probably is at times fatal to the prey.

Mating occurs in April and May. The eggs number as many as twelve, and average about eight in each clutch. They are laid in the ground; one clutch was eleven inches beneath the surface.

Kansan Subspecies.—In the southern United States and northern Mexico, eight subspecies are recognized. Two occur in Kansas: *Masticophis flagellum flagellum* (Shaw), and *Masticophis flagellum flavigularis* (Hallowell), whose type locality is Maysville, Garvin County, Oklahoma. The adults of these two can easily be distinguished on the basis of color, those of *M. f. flagellum* being black anteriorly and mottled with brownish posteriorly, whereas those of *M. f. flavigularis* are brownish throughout the length of the body. The young look more alike, but can be distinguished on the basis of the width of the narrow dark crossbands on the anterior part of the body. In *M. f. flavigularis*, these bands are one or two scales wide and are separated from each other by areas three to five scales wide and thus the bands are about one-third as wide as the interspaces; in *M. f. flagellum*, the dark bands are separated from each other by spaces only one or two scales wide, and thus the dark bands are about as broad as or broader than the interspaces.

References.—Ortenburger, 1928: 92-111, pls. 16-19 (monograph); Schmidt and Davis, 1941: 127, 130-131, pl. 13 (description, natural history); Maslin, 1953: 193-200 (taxonomy).

Genus *Elaphe* Fitzinger

Rat Snake

Elaphe guttata (Linnaeus)

Coluber guttatus Linnaeus, Syst. Nat., ed. 12, vol. 1, 1766, p. 385 (type locality—Charleston, South Carolina).
Elaphis guttatus Duméril, Bibron and Duméril, Erpét. Gén., vol. 7, 1854, p. 273.

Range.—Throughout state except western fourth and extreme northeastern corner. Peripheral localities on the west are in Meade (Schwartz Cañon), Trego and Phillips counties; in the northeast, Marshall (Blue Rapids) and Leavenworth (10 miles northeast of Lawrence) counties.

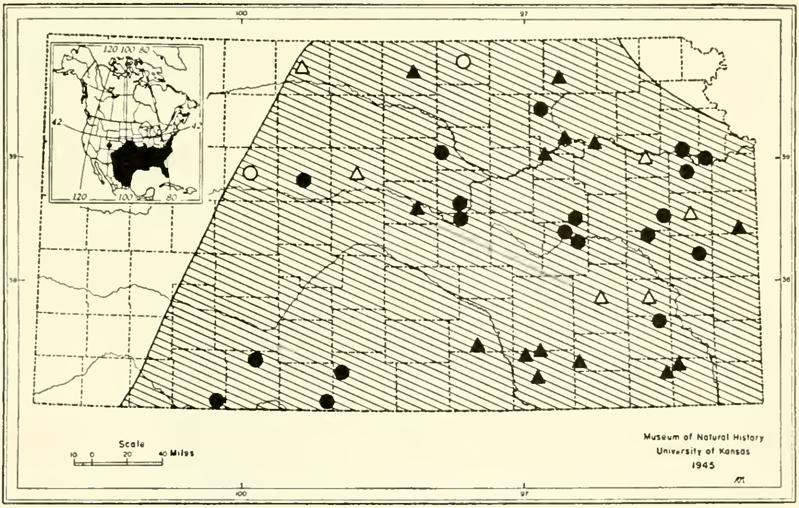


FIG. 182. Distribution of the rat snake, *Elaphe guttata*, in Kansas, with insert showing range of the species.

Description.—Head somewhat flattened, a little wider than neck; head scales much as shown in Fig. 150; one preocular; temporals 2 or more both anteriorly and posteriorly; supralabials generally 8, seldom 9; infralabials 11 to 14, generally 12 or 13. Median dorsal scale rows keeled at least feebly (except perhaps in the very young), but outer 7 rows on each side smooth; scale rows usually 25, occasionally 27 on anterior third of body, usually 27 but occasionally 29 at middle of body, and 19 or 21 immediately in front of anus; ventrals 213-232, average 220, in males, and 219-234, average 228, in females; subcaudals 66-80, average 76, in males, 60-75, average 68, in females.

Ground color gray, olive or olive-brown; a middorsal series of 25-45 well-defined, quadrangular, dark brown, black-bordered spots on body, 8 to 20 on tail; the blotches about 4 scales in length, separated by interspaces 1½-2 scales in length; a series of small, rounded blotches on sides, alternating with middorsal blotches, and another series of still smaller spots just above ventrals, alternating with those in the series above; a distinct band extending along each side of top of the head across parietals to frontal, where they merge; belly whitish or cream, with irregularly placed, quadrangular dark blotches.

Size moderately large, total length reaching forty-five inches; tail about one-fifth or one-sixth of total length.

Recognition Characters.—The most important peculiarity of this species is one of pattern: the two broad dark lines converging forward from the neck, cross the parietals and meet on the frontal. No other blotched species—or unblotched for that matter—has such a marking. Most often confused with it is *Lampropeltis calligaster*, which however has a single anal (divided in *E. guttata*); also similar are the young of *Elaphe obsoleta* and *Coluber*, neither of which, however, has the marking described for *E. guttata*.

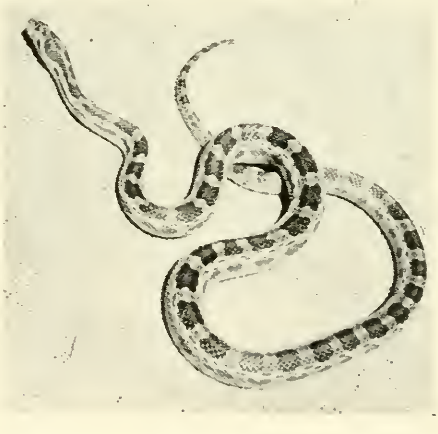


FIG. 183. A rat snake, *Elaphe guttata emoryi*, approx. × ⅓. Courtesy of the Zoölogical Society of Philadelphia.

Habits and Habitat.—This apparently is a nocturnal snake, and is found frequently in the day in hiding under stones and other objects, in caves, and in other dark places. It is usually associated with rocky hillsides or canyons, and seldom if ever occurs on the open prairie. *E. guttata* does not frequent heavily wooded areas, although it occurs commonly on sparsely or moderately heavily wooded hillsides. The food is constricted.

Nothing has been published upon the natural history of this species, although it is known to be egg-laying.

Kansan Subspecies.—Five races may be recognized, one of which, *Elaphe guttata emoryi* (Baird and Girard), type locality Howard Springs, Ellis County, Oklahoma, occurs in Kansas. The other races occur as far west as Utah, southward into Arizona and northern Mexico, and as far east as the Atlantic and Gulf coasts.

References.—Woodbury and Woodbury, 1942: 133-142 (taxonomy, description); Dowling, 1951: 39-44, figs. 1, 2; 1952: 2-3 (taxonomy).

Pilot Black Snake

Elaphe obsoleta (Say)

Coluber obsoletus Say, Long's Exp. Rocky Mts., vol. 1, 1823, p. 140 (type locality—Council Bluffs, Iowa).

Elaphis obsoletus Garman, Mem. Mus. Comp. Zoöl., vol. 8, no. 3, 1883, p. 54.

Range.—Eastern half of state. Recorded as far west as Marshall (1 mile east of Waterville), Riley (Manhattan), Saline (3 miles northeast of Salina), Harvey (10 miles northwest of Halstead), Sedgwick (8 miles west of Wichita), and Harper (Danville) counties.

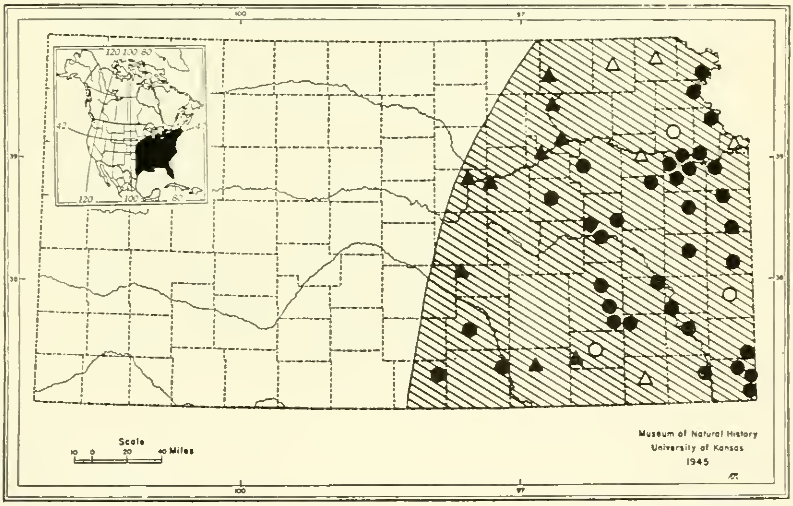


FIG. 184. Distribution of the pilot black snake, *Elaphe obsoleta,* in Kansas, with insert showing range of the species.

Description.—Head somewhat flattened, a little wider than neck; head scales much as shown in Fig. 150; one preocular; two anterior temporals, three or four posterior temporals; supralabials generally eight; infralabials generally eleven or twelve. One to eleven outer rows of dorsals on either side perfectly smooth (the fewer rows of smooth scales at posterior part of body), others feebly keeled, apparently smooth in very young; scale rows 25 or 27 on anterior three-fifths of body, 17 or 19 immediately in front of anus; anal and all subcaudals divided; ventrals 221-241 in males, 227-244 in females; subcaudals 73-91 in males, 69 to 89 in females.

Color of young and adults different. Young with gray ground color; middorsal series of 28 to 38 well defined, quadrangular, seal brown blotches 4 to 8 scales long and 11 to 14 scales wide; two series of smaller spots alternating with each other and with dorsal spots, on each side; belly whitish, with irregular, extensive dark blotches. Adults usually uniform black above, but occasionally blotches remain evident, sometimes red-bordered; belly dusky anteriorly, becoming nearly uniform posteriorly and on tail.

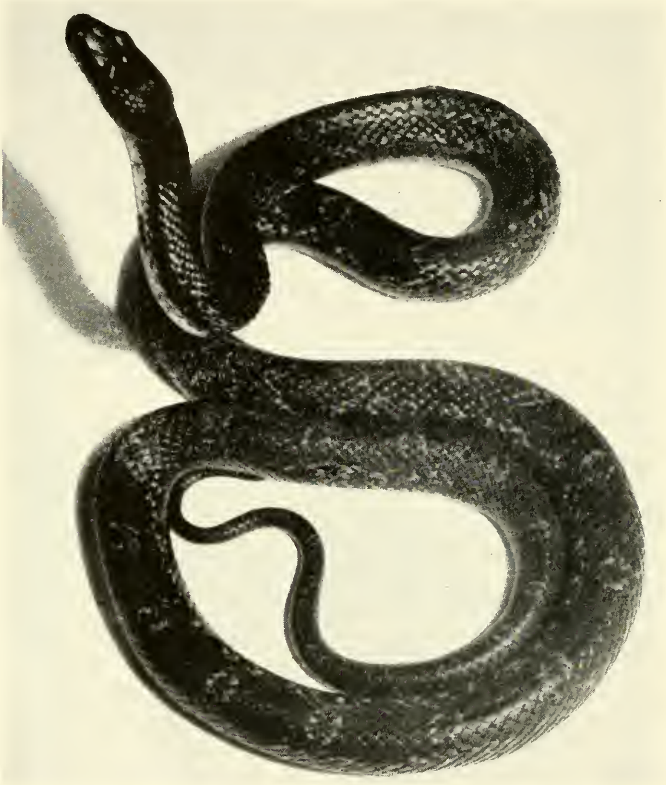


FIG. 185. An adult pilot black snake, *Elaphe o. obsoleta*, × 1/3, K. U. no. 24392, 5 miles south of Humboldt, Allen County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Size large, total length reaching eight feet, five inches; tail averaging seventeen or eighteen percent of total length.

Recognition Characters.—The adults, with their large size and nearly uniform black back, cannot be confused with any other species in the state. The young, however, have a color pattern closely resembling that of *Elaphe guttata*, *Lampropeltis calligaster*, and the young of *Coluber constrictor*. The first may be distinguished by the presence of dark bars on the top of the head crossing the parietal plates and uniting on the frontal; the king snake may be distinguished by the presence in it of an entire anal; and the blue racer differs by having two preoculars (instead of 1), and no more than nineteen scale rows (instead of more than 20).

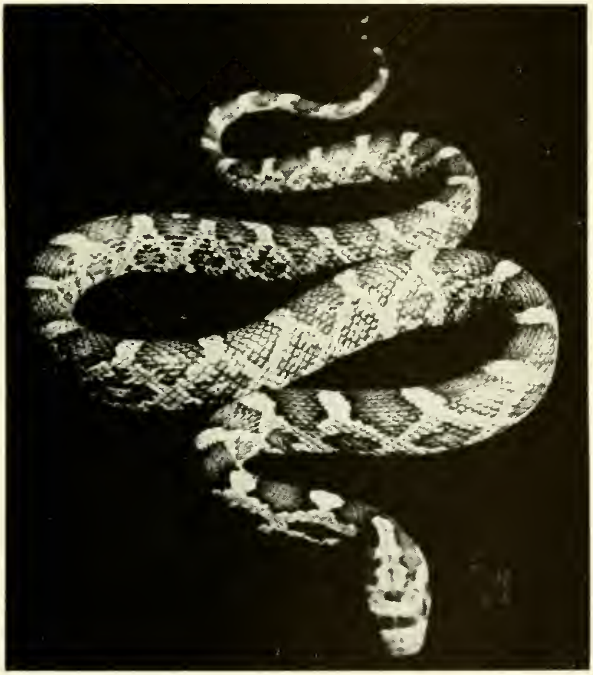


FIG. 186. A juvenal pilot black snake, *Elaphe o. obsoleta*, × 1, 4 miles south of Garnett, Anderson County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Habits and Habitat.—This species is partial to moist, wooded regions. It is a proficient climber—probably a better climber than any other snake in the state. Its climbing is done mainly in trees. It is largely diurnal in habits. Individuals frequently sun themselves.

The food consists for the most part of small mammals, and to a lesser extent of birds. Frogs and insects are occasionally eaten. The food except for smaller items is constricted. Eggs are not infrequently taken.

In Maryland mating occurs in May and June; seven to twenty-two eggs are laid in sawdust piles, loose earth, manure piles, rotten trees, logs and stumps, and other places in or near the ground, from July to early August. The eggs measure 37 to 50 mm. in length, 21 to 27 mm. in width, and hatch after some 2½ months.

When first captured these snakes ordinarily bite rather readily; the bite is painful but not of such a lacerating character as that of the blue racer and coachwhip. Pilot black snakes are somewhat more docile than either of the two species just mentioned, and some individuals even when first captured do not attempt to bite. After a time in captivity they become quite tame. When annoyed the tail is rattled, and when the snake is picked up the scent glands exude a secretion of strong and somewhat repugnant odor.

Kansan Subspecies.—Five races are recognized at present, one of which occurs in Kansas: *Elaphe obsoleta obsoleta* (Say). The other races occur in the southeastern United States from Texas and Oklahoma eastward.

References.—Conant, 1938: 55-60, pl. 8, fig. 1 (description, variation, natural history, Ohio); McCauley, 1945: 81-85, fig. 19 (description, variation, natural history, Maryland); Hudson, 1942: 58-60 (brief description, variational notes, natural history, Nebraska); Schmidt and Davis, 1941: 148-150 (description, natural history, general).

Genus *Arizona* Kennicott

Glossy Snake

Arizona elegans Kennicott

Arizona elegans Kennicott, in Baird, U. S.-Mex. Bound. Survey, vol. 2, Rept., 1859, p. 18, pl. 13 (type locality—lower Rio Grande, Texas).

Range.—Western third of state. Reported as far north and east as Cheyenne (13 miles southeast [= SSE] of Benkelman, Nebraska), Stafford (Little Salt Marsh), Reno (Hutchinson), and Harper (5 miles northwest of Harper) counties.

Description.—Head rather thick, pointed, a little wider than neck; head scales much as shown in Fig. 150; rostral enlarged, projecting backwards between internasals, not keeled above; 2 preoculars; 2 anterior and 3 posterior temporals; generally 8 supralabials; generally 13 or 14 infralabials; postgenials small, about one-tenth size of pregenials. Dorsal scales absolutely smooth; scale rows usually 29 or 31 at middle of body, 19 or 21 immediately in front of anus; anal entire; subcaudals divided; ventrals 187-219 in males, 205-226 in females; subcaudals 52-57 in males, 42-53 in females.

Ground color light gray-brown; 45-65 distinct, dark gray or brown, black-edged blotches on body; 2 series of smaller spots on either side, alternating with each other and with median spots; belly cream, without markings (unlike the otherwise similar king snakes).

Size rather large, total length reaching 44½ inches; tail comprises 14-15 percent of total length.

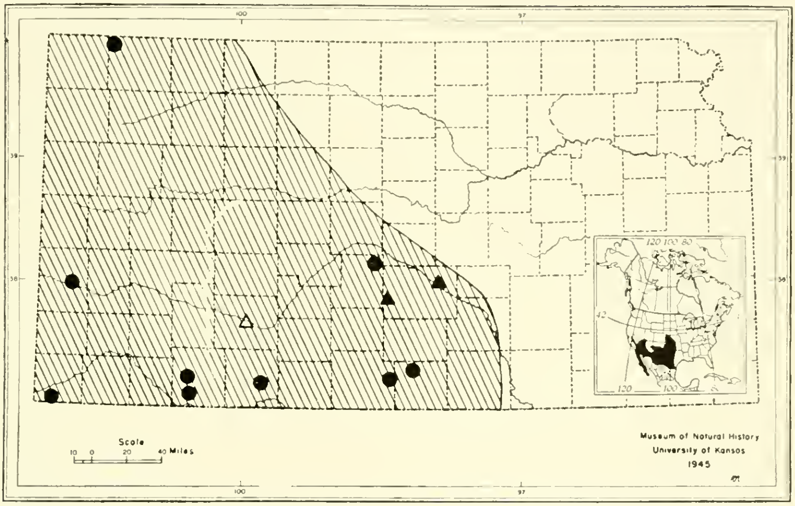

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FIG. 187. Distribution of the glossy snake, *Arizona elegans*, in Kansas, with insert showing range of the species.

Recognition Characters.—No other blotched snake in the state with smooth scales and entire anal has the ventral surfaces unmarked, except some specimens of *Rhinocheilus*, in which most of the subcaudal plates are entire.

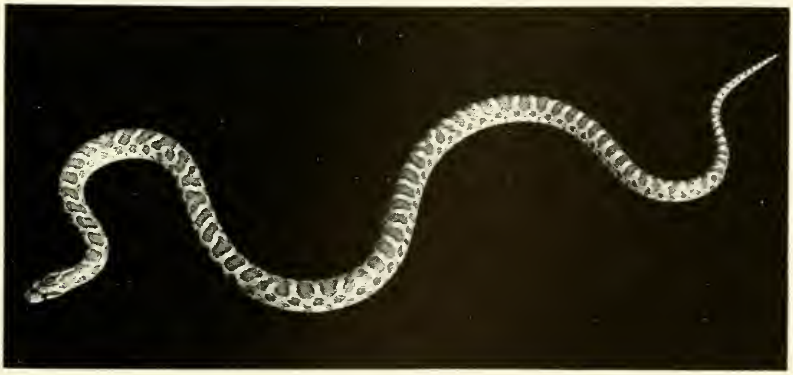


FIG. 188. A glossy snake, *Arizona elegans blanchardi*, × 1/7, from Motley County, Texas. Courtesy Louis W. Ramsey.

Habits and Habitat.—This nocturnal species is characteristic of sandy areas; it is found only in semiarid regions, on flat plains. The food, which is constricted, consists largely of lizards so far as known. A single clutch of ten eggs has been recorded.

Individuals of the glossy snake are notably wary and they are not easily approached at night, but those in captivity do not offer to bite and they are remarkably docile. The species is nonpoisonous.

Kansan Subspecies.—Nine subspecies are now recognized, one of which, *Arizona elegans blanchardi* Klauber, occurs in Kansas. The type locality is 13 miles southeast of Benkelman, Nebraska, in Cheyenne County, Kansas. The other subspecies occur in the southwestern United States and northwestern Mexico.

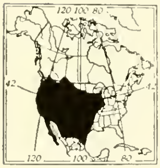
References.—Blanchard, 1924: 1-5 (variation, taxonomy); Schmidt and Davis, 1941: 156-158, fig. 44 (brief description, natural history); Klauber, 1946: 328-333 (monograph).

Genus *Pituophis* Holbrook

Bull Snake

Pituophis melanoleucus (Daudin)

Coluber melanoleucus Daudin, Hist. Nat. Rept., vol. 6, 1803, p. 409 (type locality—Charleston, South Carolina, by restr.).
Pituophis melanoleucus Holbrook, N. Amer. Herp., ed. 2, vol. 4, 1842, p. 7 pl. 1.



Range.—State-wide. Less abundant in the eastern quarter of the state, and uncommon along the eastern border in extensively wooded areas. No other reptile in Kansas is recorded, however, from localities in so many different counties.

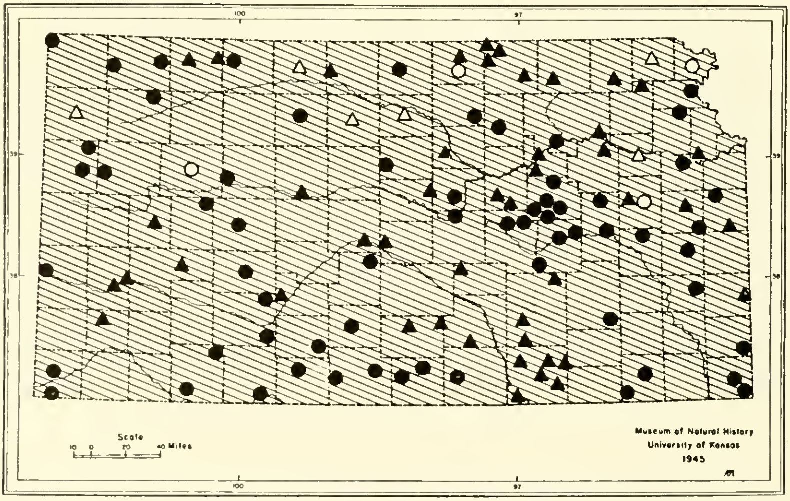


FIG. 189. Distribution of the bull snake, *Pituophis melanoleucus*, in Kansas.

Description.—Head somewhat thickened, a little wider than neck; snout pointed; head scales much as shown in Fig. 150; rostral enlarged and projecting somewhat beyond the general level of the head, about twice as high as wide, half separating internasals; nasal divided; 4 prefrontals; often 1 or 2 small scales preceding frontal, between prefrontals; preoculars usually 1, sometimes 2; postoculars 2-5, usually 3 or 4; usually 1 loreal, sometimes 2, rarely 0; 3 or 4 rows of temporals; parietals small, broken into small scales at rear margin; postgenials one-fourth size of pregenials. Dorsal scales prominently keeled, but 5-9 anterior rows and 1-4 posterior rows on each side smooth; scale rows 25-35 on anterior third of body (except immediately back of head), 28-37 at middle of body, and 21-27 immediately in front of anus; anal plate entire; all subcaudals divided; ventrals 211-236, average 223, in males, and 215-244, average 227, in females; subcaudals 49-67, average 59, in males, and 47-65, average 53, in females.

"Ground color above pale brownish-yellow with a median row of 33-73 (av. 51) large brown or black blotches in front of vent; 3 or 4 rows of more or less indistinct small blotches along either side; blotches usually black on forward part of body, brown along middle and black toward posterior end; all blotches black in a few individuals; median blotches broader anteriorly but forming narrower cross-bars toward tail; head speckled with black; vertical margins of upper and lower labials black; 9-15 black bars across upper side of tail; under surface yellowish-white, sparsely or thickly mottled with black, rarely immaculate." (Hudson, 1942, pp. 62-63.)

Size large, total length reaching 83 inches; tail 10 to 14 percent of total length.

Recognition Characters.—The four prefrontals are absolutely distinctive of this species of snake, in Kansas. Characteristic also is the high, narrow rostral; in all other species it is not twice as long as broad. The pointed head, yellowish ground color and nearly square dark spots on back are other distinctive features.

Habits and Habitat.—This is a terrestrial, diurnal species characteristic of plains regions. In wooded areas it occurs in open meadows, fields and grasslands.

Upon discovery this reptile usually reacts by vibrating the tail, drawing the head back into a striking position, and hissing loudly through slightly parted lips. The hiss has a considerable similarity to the rattle of a rattlesnake, consisting of a hoarse, vibrating sound. It is produced by forcing air past a median vertical vanelike cartilage attached at its upper and lower tips to the opening of the windpipe; the cartilage whips back and forth like a flag in the breeze as the air rushes past it, and produces the peculiar vibrating effect of the hiss. The structure bears some resemblance to the epiglottis of mammals, and for this reason these snakes were once placed by taxonomists in the genus *Epiglottophis* (epiglottis-snake).

While these snakes ordinarily strike frequently when first captured, they readily become tame and refuse to bite unless provoked unduly. They moreover eat readily in captivity and for these reasons make good pets.

The food consists largely of small mammals, which are killed by constriction, unless the prey is too small or in such confining quarters that loops of the snake's body cannot be thrown about the food. Mammals as small as young mice and rats are eaten as captured, alive. Others are first killed. The snake usually searches out its prey in burrows, or similar confines, and thus kills by compressing the animal against the wall of the burrow. Sight ordinarily is little used by the snake in catching food. When killing or capturing prey, any touch upon the snake's body causes it to attempt to compress or constrict whatever is there; thus several animals may be killed at once, and in fact a snake was once observed to kill three half-grown rats at one time. These snakes are extremely proficient "mousers,"

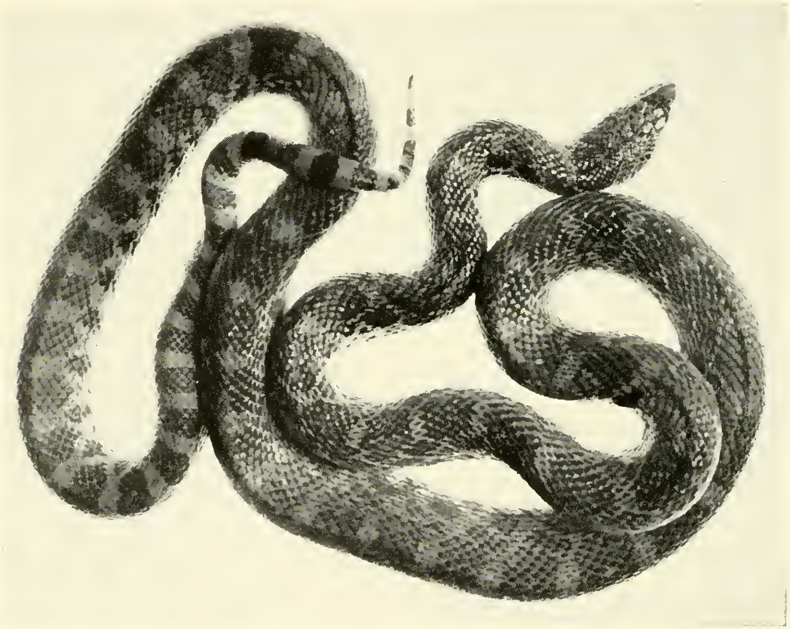


FIG. 190. A bull snake, *Pituophis melanoleucus sayi*, × ⅓, 9 miles southwest of Clinton, Douglas County, Kansas. Photo by R. R. Hamm.

and will rid barns and other buildings of rats and mice much more efficiently than cats. Many farmers encourage the snakes to remain about their buildings for that reason, and import them when they are especially needed. It is estimated that an adult snake of average size eats the equivalent of some twelve full-grown pocket gophers every season. On this basis the value of a bull snake has been computed to be about $3.75 per year. There is a certain cycle of activity—feeding, fasting and moulting—repeated about every thirty days. Ordinarily the food is swallowed head-first.

Not only are these snakes of great value about human habitations, but in the fields they eat large numbers of rodents injurious to agriculture. They wreak havoc in communities of gophers and prairie dogs; gopher snake is the vernacular name applied to this species in several western states, as for example Nevada and California. Unfortunately they occasionally turn to eating birds and eggs. The eggs are crushed as they pass through the esophagus.

Ten to sixteen eggs are laid in July and hatch about two months later. The eggs measure 42-52 mm. in length and 28-38 in width. The hatchlings measure approximately 15 inches in total length and shed their skins about ten days later. They apparently do not eat for several weeks; in captivity they may overwinter before eating; others have eaten nine weeks after hatching.

Kansan Subspecies.—About eleven races of this species are known, only one of which is recognized in Kansas. It is *Pituophis melanoleucus sayi* (Schlegel) with type locality at Carthage, Jasper County, Missouri. The other races occur throughout most of the United States and in northwestern Mexico.

Reference.—Stull, 1940: 91-122, fig. 50a (monograph).

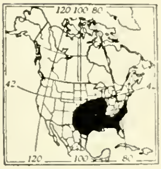
Genus *Lampropeltis* Fitzinger

Blotched King Snake

Lampropeltis calligaster (Harlan)

Coluber calligaster Harlan, Journ. Acad. Nat. Sci. Phila., vol. 5, 1827, p. 359 (type locality—St. Louis, Missouri).

Lampropeltis calligaster Cope, Proc. Acad. Nat. Sci. Phila., 1860, p. 255.



Range.—State-wide, except northwestern corner. Recorded as far northwest as Republic, Mitchell, Ellis (5 miles south of Martin), Gove, Logan, and Hamilton (1 mile east of Coolidge) counties.

Description.—Head thick, blunt, cylindrical, little wider than neck; head scales much as shown in Fig. 150; preocular single; supralabials generally seven, sometime eight; infralabials generally nine or ten; temporals two in anterior row, three or four in posterior rows. Dorsal scales absolutely smooth; scale rows 23-25 on anterior third of body, 23-27 (usually 25) at middle of body, 19-21 immediately in front of anus; anal entire; subcaudals divided; ventrals 194-215; subcaudals 44-57, average 51, in males, and 38-52, average 46, in females.

Ground color gray or gray-brown; a series of 46-78 (average 60) dark gray, black edged blotches down middle of body, including tail; spots 11-12 scales wide and 2-4 long; two or three series of dark spots on each side, alternating with the middorsal series and with each other; spots usually white-edged; belly whitish, with irregular dark markings.

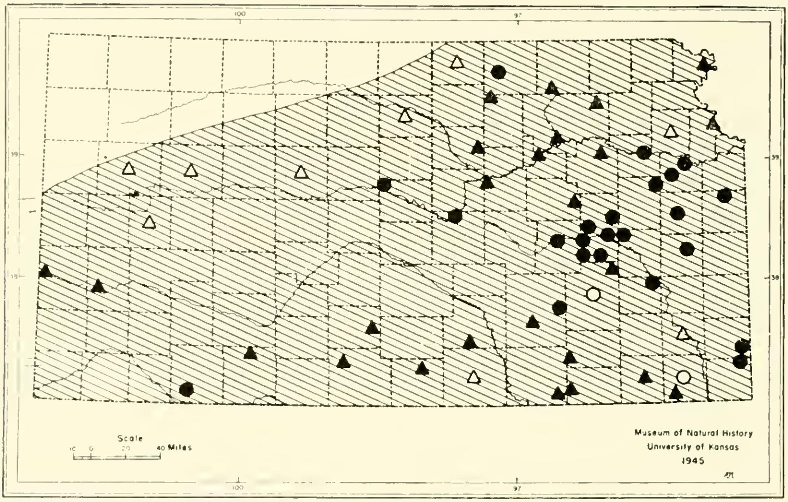


FIG. 191. Distribution of the blotched king snake, *Lampropeltis calligaster*, in Kansas.

Size moderately large, reaching a total length of 53⅛ inches; tail 11 to 15 percent of total length.

Recognition Characters.—No other snake in Kansas has the combination of smooth scales, entire anal, a pattern of blotches, and the belly marked, except *Rhinocheilus*, which is easily distinguished by having most of the subcaudals entire. *Elaphe guttata* is most frequently confused with the blotched king snake probably because the color pattern is remarkably similar. In *Elaphe*, however, the anal is divided and the dorsal scales are weakly keeled. Another species, not commonly found in the state, resembles *L. calligaster* even more closely; it is *Arizona elegans*, and can be distinguished most easily by the complete absence of ventral markings.

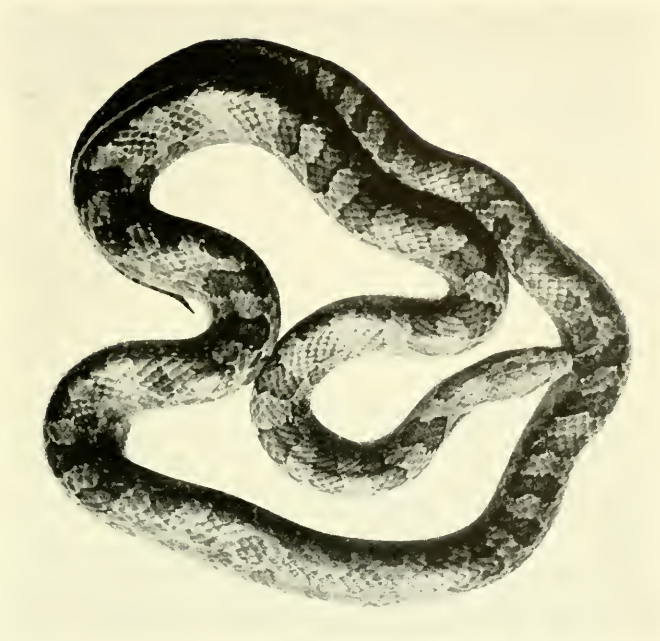


FIG. 192. A blotched king snake, *Lampropeltis c. calligaster*, × ½, 9 miles southwest of Clinton, Douglas County, Kansas. Photo by R. R. Hamm.

Habits and Habitat.—This species is nocturnal. Individuals are most frequently found wandering about at night in open fields, along roads, about pastures or near barns; they live mostly in prairie areas, in open woods and fields, spending the day under cover of stones, old boards or logs.

These snakes are docile and rarely attempt to bite. The bite is painful, but not poisonous.

The food consists almost entirely of mice. In captivity other kinds of warm-blooded vertebrates are eaten, but large numbers of these snakes examined in the field have contained only mice. The food is constricted, and probably is killed also by compression in the same way that the bull snake is known to kill its prey.

A clutch of eleven eggs, plowed up in a field, has been recorded. They hatched in early September.

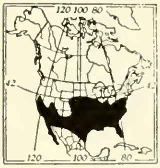
Kansan Subspecies.—Only two races are known of this widely distributed species, and one occurs in Kansas: *Lampropeltis calligaster calligaster* (Harlan). The other race, *L. c. rhombomaculata* (Holbrook), occurs in the southeastern United States.

Reference.—Blanchard, 1921: 115-127, figs. 6, 39, 40 (monograph).

Speckled King Snake

Lampropeltis getulus (Linnaeus)

Coluber getulus Linnaeus, Syst. Nat., ed. 12, vol. I, 1766, p. 382 (type locality—Charleston, South Carolina).
Lampropeltis getula Cope, Proc. Acad. Nat. Sci. Phila., 1860, p. 255.



Range.—Probably state-wide, although not reported west of Rawlins (4 miles northeast of Ludell), Logan, Scott, Kearny (2 miles east of Lakin) and Meade (State Park) counties.

Description.—Head thick, blunt, cylindrical, little wider than neck; head scales arranged much as in Fig. 150; preocular single; supralabials generally seven; infralabials generally nine; temporals two in anterior row, three or four in posterior rows. Dorsal scales absolutely smooth; scale rows 19-21 on anterior third of body, 19-23 at middle of body, and 17-19 immediately in front of anus; anal entire; subcaudals divided; ventrals 200-220; subcaudals 37-55.

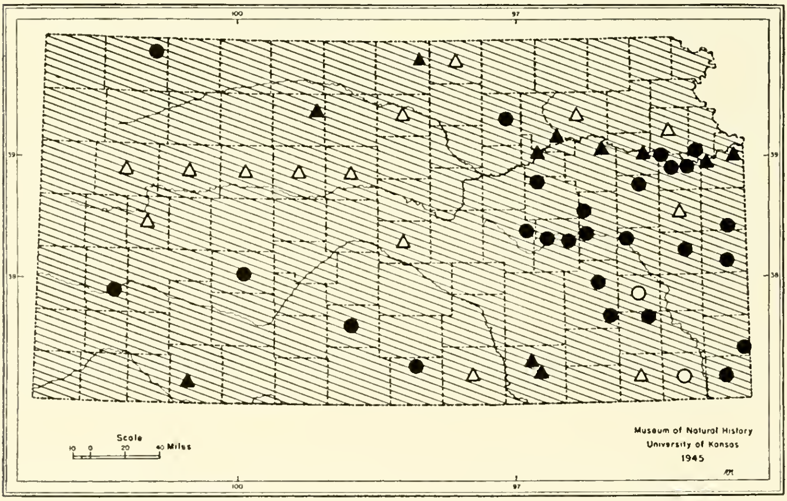


FIG. 193. Distribution of the speckled king snake, *Lampropeltis getulus*, in Kansas.

Black or blue-black above; adults with a light yellow spot in the middle of every dorsal scale, the size of the spots increasing laterally so that the scales appear light with a black border; frequently the light spots are so arranged that they form 50 to 100 spotted cross-bars; in such specimens the scales in the middorsal region between the cross-bars frequently have less distinct spots, so that a faint blotched effect is produced; this is especially prominent in young specimens, and the blotched appearance becomes less and less distinct as the animals grow. The venter is whitish and is blotched with black.

Size moderately large, reaching a total length of 64⅜ inches; tail 10 to 15 percent of total length.

Recognition Characters.—No other species in the state has a black back on which most scales are yellow-centered. The species is not easily confused with any other.

Habits and Habitat.—This is another nocturnal snake, as are the other species of the genus *Lampropeltis,* and occurs in a rather wide variety of habitats in which ample moisture seems the most characteristic feature. The snakes are sometimes plowed up, indicating that they spend some part of their time underground, and perhaps they generally live in holes in the ground; they have been found also under stones and logs in hilly areas and canyons.

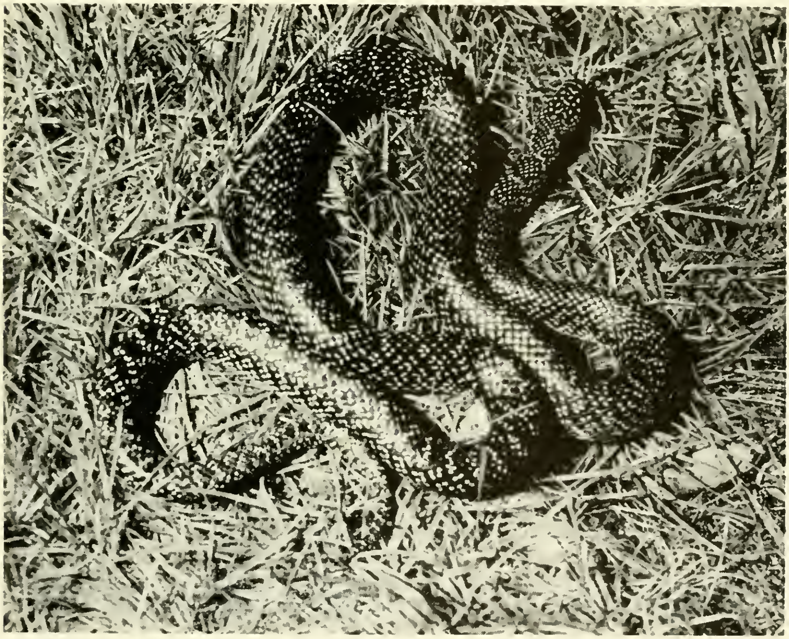


Fig. 194. A speckled king snake, *Lampropeltis getulus holbrooki,* × ½, K. U. no. 24403, 1 mile north of Lawrence, Douglas County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

The food is normally more varied than that of *L. calligaster,* consisting of snakes, lizards, eggs, small mammals and some birds. Poisonous snakes are eaten as well as nonpoisonous. Most of the food is constricted, but small animals are eaten without delay.

The snake is more nervous than *L. calligaster*, striking upon capture and vibrating the tail. After even several months in captivity the snake will vibrate its tail when annoyed. It does not eat well in captivity.

Little has been recorded of the breeding habits. It is known that mating occurs in May, and that the eggs, six to ten (average 9) in number, are laid in late June; the eggs measure approximately 35 × 18 mm., and hatch from late August to early October; the hatchlings measure about ten inches in total length.

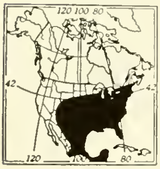
Kansan Subspecies.—Ten subspecies of this species are recognized, only one of which occurs in Kansas. It is *Lampropeltis getulus holbrooki* Stejneger, whose type locality is the Valley of the Mississippi. The other subspecies occur in the southern half of the United States and in northern Mexico. Specimens of *L. g. holbrooki* from southwestern Kansas in color pattern approach *L. g. splendida,* but in other respects are typical of *L. g. holbrooki.*

References.—Blanchard, 1921: 33-42, fig. 32 (monograph); Conant, 1938: 63-66 (habits of a related subspecies, *L. g. nigra*, Ohio).

Red King Snake

Lampropeltis triangulum (Lacépède)

Coluber triangulum Lacépède, Hist. Nat. Quadr. Ovip. Serp., vol. 2, 1788, tabl. méth., p. 86 (type locality—New York, New York).
Lampropeltis triangula Cope, Proc. Acad. Nat. Sci. Phila., 1860, p. 256.



Range.—State-wide. Not yet recorded south of the Arkansas River except in the southwestern corner of the state and in Sedgwick County, nor in a similar area at the northern border of the state, but to be expected.

Description.—Head thick, blunt, cylindrical, little wider than neck; head scales much as shown in Fig. 150; preocular single; supralabials generally seven; infralabials generally nine; temporals two in anterior row, three or four in posterior rows. Dorsal scales absolutely smooth; scale rows 19-21 anteriorly, 19-23 at middle of body, and 17-21 immediately in front of anus; anal entire; subcaudals divided; ventrals 176-215; caudals 41-54, average 48, in males, and 31-50, average 46, in females.

Ground color whitish or cream, frequently suffused with gray; a series of 19 to 30 large, red, black-edged blotches on body, 0-6 on tail; white spaces between blotches covering 1 to 2½ scale lengths; red blotches extending laterally to about the third scale row, sometimes onto edges of belly; belly thickly mottled with black, the color fused with the black borders of the red blotches.

Size moderate, total length reaching 41¾ inches; tail 12 to 16 percent of total length.

Recognition Characters.—The color pattern, of large, red blotches, is completely distinctive of this species. At first glance *Rhinocheilus* might be confused with this species, but it has most of the subcaudals single instead of entire.

Habits and Habitat.—This snake occurs in a wide variety of habitats in the state. It is nocturnal, and apparently has a proclivity for burrowing, as it is frequently found in plowing. It is found also under stones and logs.

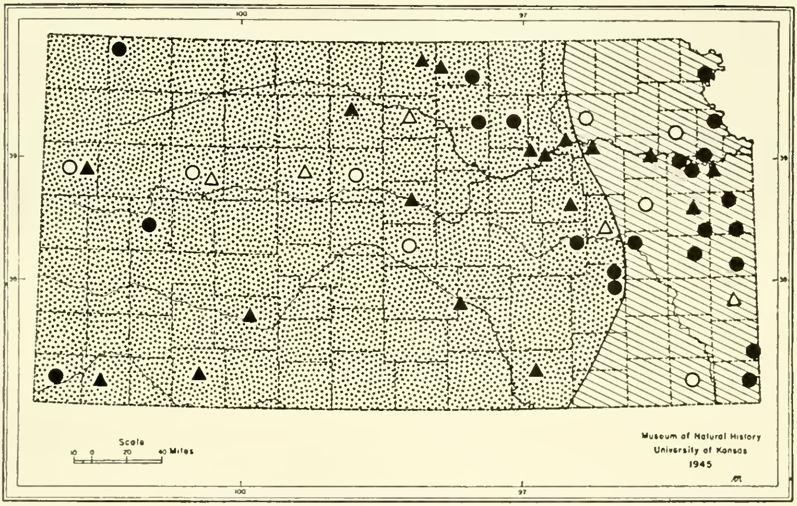


FIG. 195. Distribution of the red king snake, *Lampropeltis triangulum*, in Kansas. The range of *Lampropeltis triangulum syspila* in the eastern part of the state is indicated by the lined area, and that of *Lampropeltis triangulum gentilis* by the stippled area.

When captured this species seldom bites; it is extremely docile, but does not thrive well in captivity.

The food, which usually is constricted, consists chiefly of small mammals, and to a lesser extent of snakes (even of its own species), lizards, birds, insects, earthworms and spiders. The species is less addicted to feeding upon other snakes than are most other kinds of king snakes.

Few data are recorded on the breeding habits of the races occurring in Kansas. In the eastern race eleven to sixteen eggs, measuring 30 × 16 mm., are laid in June and July in the ground or in piles

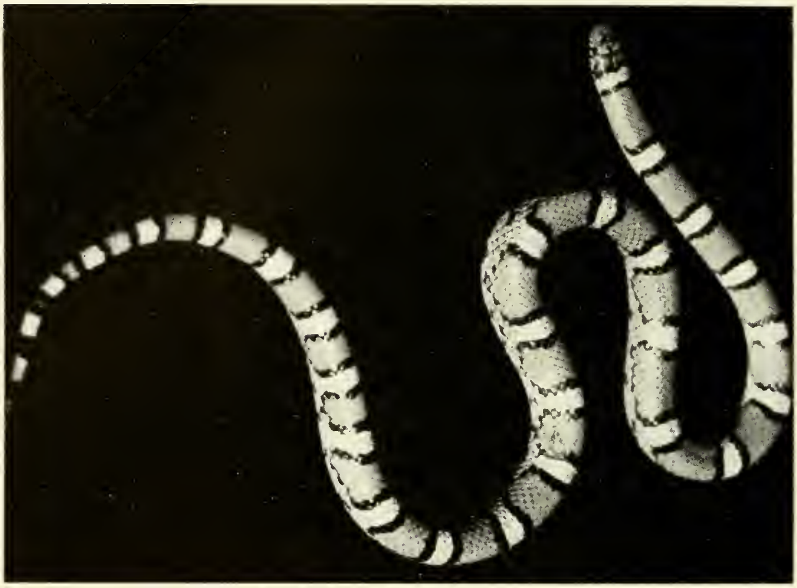


FIG. 196. A red king snake, *Lampropeltis triangulum syspila*, × ½, K. U. no. 24401, 4 miles east of Baxter Springs, Cherokee County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

of refuse; the hatchlings, nine inches long, appear in September.

Kansan Subspecies.—This species, consisting of some fourteen races as now known, is represented in Kansas by two subspecies: *Lampropeltis triangulum gentilis* (Baird and Girard), whose type locality is the north fork of the Red River, near Sweetwater Creek, Wheeler County, Texas, and *Lampropeltis triangulum syspila* (Cope), whose type locality is Richland County, Illinois. According to Blanchard, the two characters which are most useful in distinguishing these two races are as follows: In *L. t. gentilis*, at least the posterior half of the upper side of the head is black, without red; and the black borders of the red rings tend to encroach middorsally upon the red, expanding inward into each red blotch. In *L. t. syspila* there is an extensive red area on the posterior part of the head, generally black-bordered to be sure, but the black borders do not ordinarily occupy more area than the red; and the red dorsal blotches are not encroached upon by their black borders.

In a rather broad area on the western border of the eastern one-fourth or one-third of the state, some difficulty may be experienced in distinguishing specimens of the two subspecies from each other; in fact this area is one of intergradation, and the person wishing to identify specimens to subspecies should not be concerned so much with the appearances of single specimens as with lots of specimens; a series of specimens from each area is almost necessary before accurate determination as to subspecies can be made.

References.—Blanchard, 1921: 165-171, 179-187, figs. 52, 68, 72 (monograph); Conant, 1938: 66-70, and McCauley, 1945: 93-100 (habits of related races, *L. t. triangulum* and *L. t. temporalis;* most of the observations will apply also to the Kansan subspecies).

Genus *Rhinocheilus* Baird and Girard

Long-nosed Snake

Rhinocheilus lecontei Baird and Girard

Rhinocheilus lecontei Baird and Girard, Cat. N. Amer. Rept., 1853, p. 120 (type locality—San Diego, California).

Range.—Southwestern quarter of state. Recorded as far north as Morton (3 miles north of Elkhart), Finney (Garden City), Ford (Bellefont), Barber (Medicine Lodge) and Harper (5 miles west of Attica) counties.

Description.—Head thick, pointed, little wider than neck, cylindrical; head scales much as shown in Fig. 150; rostral swollen, prominent, as wide as high; usually one preocular; temporals usually two in anterior row, three in posterior row; supralabials 7-9, usually 8; infralabials 8-11, usually 9; posterior genials usually split into 2 or more scales. Dorsal scales absolutely smooth; scale rows 23 or, rarely, 25 about middle of body, 19 immediately in front of tail; anal plate and at least half the subcaudals entire; ventrals 191-209, average 200, in males, and 181-203, average 195, in females; subcaudals 50-61, average 54, in males, and 43-54, average 49, in females.

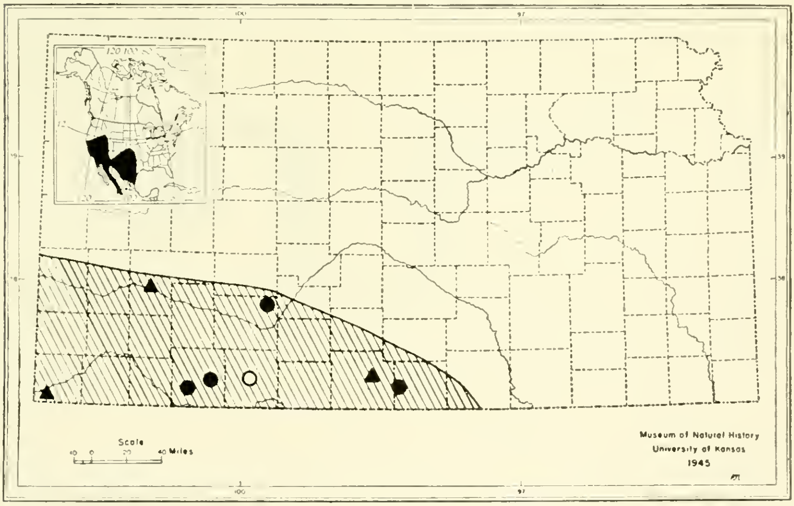


FIG. 197. Distribution of the long-nosed snake, *Rhinocheilus lecontei*, in Kansas, with insert showing range of the species.

Ground color yellowish or cream; a series of 18-35, average 26, dark blotches on body, 6-17, average 10, on tail; blotches equal to length of interspaces, to 2½ times as long; scales at sides of blotches with light centers; most of sides of body below blotches irregularly mottled with light and dark color, sometimes (especially in the young) arranged to form a lateral series of blotches alternating with the dorsal spots; spaces between middorsal blotches unmarked, pink or red in life; lighter areas on sides also at times suffused with pinkish in life. Belly cream or whitish, unicolor or marked irregularly with black or dark brown.

Size moderately large, total length reaching 37 inches; tail 12 to 17 percent of total length.

Recognition Characters.—With the exception of the pit vipers (the rattlesnakes, cottonmouth and copperhead), this is the only species of snake in the state which has a large proportion (at least half) of the subcaudals undivided. All others have only divided subcaudals, except for certain variants which may have one to a half-dozen or so plates abnormally entire.

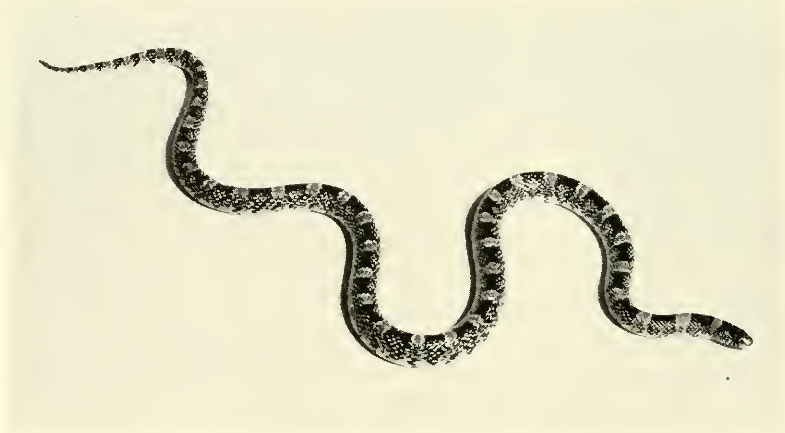


FIG. 198. A long-nosed snake, *Rhinocheilus lecontei tessellatus*, × ¼, from Baylor County, Texas. Courtesy Louis W. Ramsey.

Habits and Habitat.—In southern California, where studied more intensively than elsewhere, these snakes are found chiefly in grassy or bushy, semiarid regions, and to a lesser extent in rocky areas. The snakes are almost exclusively nocturnal, and reach their greatest activity between 8:00 and 9:00 p. m. They wander about when temperatures are as low as 62° F., and as high as 87° F. More individuals are to be found in the open in May than in any other month. They burrow readily in loose soil, but if conditions permit they hide by entering crevices rather than by burrowing in the ground.

Six to nine eggs are laid in late June or July; they measure approximately 26 × 16 mm. and hatch in August.

These are rather docile snakes which bite with some reluctance. The tail is vibrated when the snake is annoyed.

The food consists of snakes, lizards, lizard eggs, small mammals and large insects such as grasshoppers. Most of the food is constricted.

Kansan Subspecies.—One subspecies, *Rhinocheilus lecontei tessellatus* Garman, occurs in Kansas. Its type locality is Monclova, Coahuila, Mexico. One other race is recognized in the southwestern United States and northwestern Mexico.

Reference.—Klauber, 1941: 302-308, 320-323, pl. 12, fig. 2, pl. 13, fig. 3 (monograph).

Genus *Sonora* Baird and Girard

Plains Ground Snake

Sonora episcopa (Kennicott)

Lamprosoma episcopum Kennicott, U. S.-Mex. Bound. Surv., 1859, p. 22, pl. 8, fig. 2 (type locality—Eagle Pass, Maverick County, Texas).
Sonora episcopa Stickel, Copeia, no. 4, 1938, p. 184.

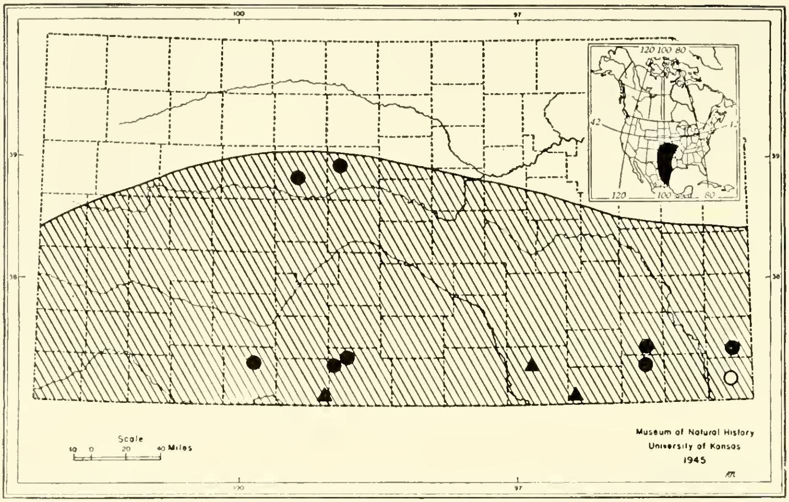
Range.—Southern half of state; known distribution in regions contiguous to Kansas indicates a wider distribution within the state than do the scanty state records themselves. Selected record stations are Clark (2 miles south of State Lake) on the west and Ellis (Hays), Russell (5 miles north of Russell), Wilson (2 miles northwest of Neodesha), and Crawford (7 miles west of Pittsburg) counties, on the north.

Description.—Head somewhat flattened above, but still fairly thick, little wider than neck; head scales much as shown in Fig. 150; 1 preocular; loreal occasionally absent; 2 posterior temporals; postgenials small or absent; usually 7 upper and 7 lower labials. Dorsal scales absolutely smooth; scale rows 15 throughout length of body (occasionally 14 immediately in front of anus); anal and all subcaudals divided; ventrals 134-155, average 147, in males, and 140-162, average 153, in females; subcaudals 39-52, average 44, in males, and 31-44, average 37, in females.

Gray, dark brown or red above, cream or whitish below; no markings except sometimes above; back occasionally uniform, unmarked; sometimes a black, collarlike spot on neck; a variable number (1-25) of black, oval crossbands sometimes present on back.

Size small, total length reaching 14 inches; tail 16 to 21 percent of total length.

Recognition Characters.—The smooth scales in fifteen rows are absolutely distinctive of this species with the exception of the smooth-scaled green snake (*Opheodrys vernalis*); the latter however has postgenials as long as the pregenials, and of course a much different color and build. The thick, broad head is distinctive.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University of Kansas
1945

FIG. 199. Distribution of the plains ground snake, *Sonora episcopa,* in Kansas, with insert showing range of the species.

Habits and Habitat.—These ground snakes are characteristic of plains and are found most frequently under stones and other surface debris on sides and crests of grassy hills. They are apparently nocturnal in habit. The food probably consists of small insects and other arthropods, although no direct observations have been made. The food probably is not constricted.

Nothing is known of the breeding habits of this species. A related

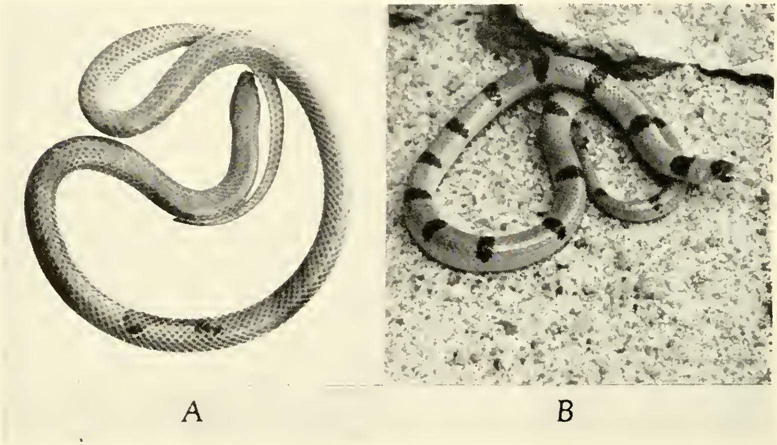


FIG. 200. Plains ground snakes, *Sonora episcopa,* × ⅔. A, locality unknown; courtesy A. A. and A. H. Wright. B, St. Clair County, Missouri; courtesy H. K. Gloyd.

form of southern Texas is known to lay eggs, one specimen laying 6 that measured approximately ⅘ × ⅕ inches.

Kansan Subspecies.—No subspecies have been distinguished, although a related form in Texas (*S. taylori*) by some writers has been considered to be a subspecies of *S. episcopa.*

References.—Schmidt and Davis, 1941: 199-200, fig. 64 (description); Stickel, 1938: 183, 184-185 (diagnosis); Cope, 1900: 938-939, fig. 238.

Genus *Tantilla* Baird and Girard

Slender Tantilla

Tantilla gracilis Baird and Girard

Tantilla gracilis Baird and Girard, Cat. N. Amer. Rept., 1853, p. 132 (type locality—Indianola, Texas).

Range.—Eastern half of state, seemingly not reaching the Nebraska border. Recorded as far west as Riley (Garrison), Geary (4 miles south of Ft. Riley), Chase (3 miles west of Strong), and Sumner counties.

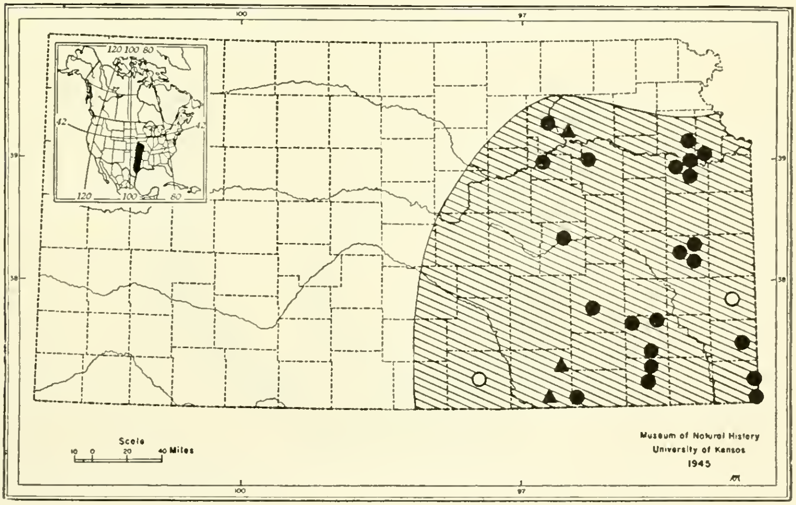


FIG. 201. Distribution of the slender tantilla, *Tantilla gracilis,* in Kansas, with insert showing range of the species.

Description.—Head much flattened, little if any wider than neck; head scales much as shown in Fig. 150; one preocular; no loreal; one postocular (seldom 2); six supralabials and infralabials (seldom 7); one anterior and one posterior temporal; postgenials half as long as pregenials. Dorsal scales absolutely smooth; fifteen scale rows throughout length of body; anal plate and subcaudals divided; ventrals 115-127, average 122, in males, and 126-138, average 132, in females; subcaudals 44-57, average 51 in males, and 36-48, average 42, in females.

Body light yellow-brown above, the color becoming *gradually* darker on head; belly whitish.

Size small, maximum total length recorded 8⅞ inches; tail about 23 percent of total length.

Recognition Characters.—The tantillas and some pit vipers are the only snakes of the state that lack the loreal. When only one scale is present between the eye and nasal, however, it is not always easy to say offhand whether it is a loreal or a preocular; since certain other snakes regularly lack the preocular, confusion can occur. The single scale can be identified as a preocular if it is as high as long (or higher), and as a loreal if it is longer than high. In identifying a snake that may be a tantilla, it is helpful to remember that only three other snakes in the state ever have fifteen smooth scale rows and a divided anal. They are: *Diadophis punctatus* (with a conspicuous light ring about neck), *Opheodrys vernalis* (green above, more than 80 subcaudals, postgenials twice as long as broad), and

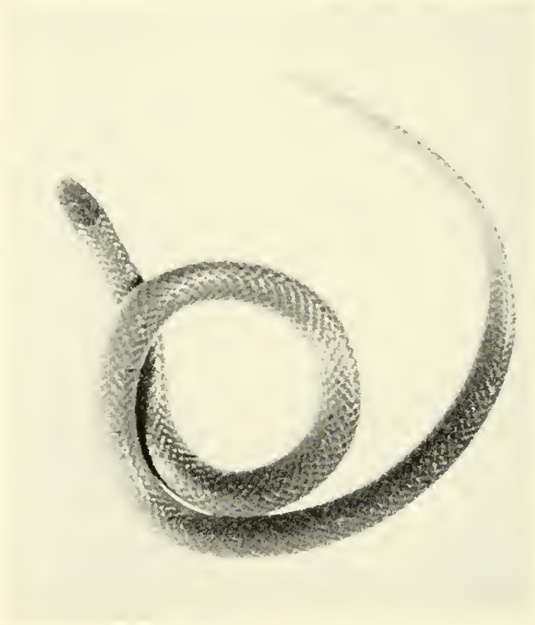


Fig. 202. A slender tantilla, *Tantilla gracilis hallowelli*, × 1, K. U. no. 23689, 3 miles north of Galena, Cherokee County, Kansas. Photo by Mrs. Virginia C. Unruh and T. P. Lyle.

Sonora episcopa (postgenials separated from each other and sometimes indistinguishable; 2 posterior temporals; much thicker head).

The present species, *T. gracilis*, is most certainly distinguished from *T. nigriceps* by the gradual change of the color on the body to the darker color of the head; in *T. nigriceps* the head is darker than the body, but there is absolutely no graduation between the colors on the nape; the black of the head terminates posteriorly at a sharply defined line. Also *T. gracilis* usually has six supralabials and one postocular, whereas *T. nigriceps* always has seven supralabials and two postoculars. Since these characters based on scales vary, however, the color characteristic, which does not vary, should be given greater emphasis. A further difference occurs in the number of ventrals: *T. nigriceps* has no less than 146, and *T. gracilis* no more than 138.

Habits and Habitat.—This snake is commonly found under stones on the hills of eastern Kansas where trees are scarce and the vegetation is chiefly grass. Probably it is nocturnal. The snakes are extremely docile and rarely if ever attempt to bite. While they possess venom, it is so weak, as far as mammals are concerned, that no risk whatsoever attends the capture and handling of these snakes.

The food consists of elongate insect larvae and centipedes. These are kinds of animals that would be found underground or under objects where these snakes abound. Probably the food is rendered somewhat helpless by the venom. A pair of enlarged teeth at the rear of the mouth have faint grooves along the side, which facilitate conduction of the poisonous saliva into the wounds made by the teeth. Teeth such as these are termed "pleuroglyph," as opposed to "opisthoglyph" teeth of some snakes of the United States and elsewhere, in which the sharp teeth have grooves along the front margin. Opisthoglyph teeth occur only at the rear of the jaws. Still other types of teeth are the solenoglyph and proteroglyph types; one is movable (that is, the bone to which it is attached moves), whereas the other (proteroglyph) is fixed; both are types occurring in the front of the jaws, and are possessed by dangerously venomous snakes. In each the groove has closed over so that there is a cavity, or canal, running the length of the tooth, down which the venom is forced, in much the same manner as fluids are forced through a hypodermic needle. The salivary gland which secretes the venom has a direct connection with the base of the tooth, with the result that all of the secretion goes into and through the teeth, rather than being freed loose in the mouth as in snakes with pleuroglyph and opisthoglyph teeth. The venom is a specialized saliva.

T. gracilis in June and early July lays one to four eggs 13-26 × 4-6½ mm. in size; they hatch in September.

Kansan Subspecies.—Two subspecies are recognized. The one occurring in Kansas is *T. g. hallowelli* Cope, with type locality restricted to Manhattan, Riley County, Kansas. The other subspecies, *T. g. gracilis,* occurs in Texas and southern Oklahoma.

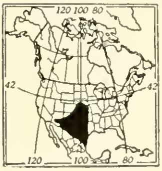
References.—Blanchard, 1938: 371-372, 376 (diagnosis); Force, 1935: 645-659 (natural history, Oklahoma); Taylor, 1936: 337-339 (variation).

Black-headed Tantilla

Tantilla nigriceps Kennicott

Tantilla nigriceps Kennicott, Proc. Acad. Nat. Sci. Phila., 1860, p. 328 (type locality —Fort Bliss, Texas).

Range.—Entire state except eastern third. Recorded as far east as Riley (4½ miles south of Manhattan), Douglas and Cowley counties (the latter two doubtful), and as far to the northwest as Hamilton, Kearny (1 mile east of Lakin), Gove, and Rooks (5 miles northwest of Stockton) counties.



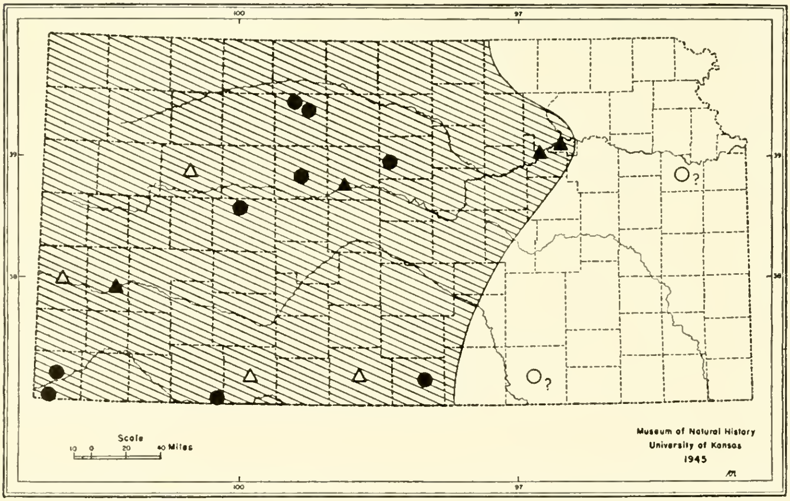


FIG. 203. Distribution of the black-headed tantilla, *Tantilla nigriceps,* in Kansas.

Description.—Head much flattened, little if any wider than neck; head scales much as shown in Fig. 150; 1 preocular; no loreal; 2 postoculars; 7 supralabials; 6 infralabials; 1 anterior and 1 posterior temporal; postgenials half as long as pregenials. Dorsal scales absolutely smooth; 15 scale rows throughout length of body; anal plate and subcaudals divided; ventrals 146-159, average 143, in males, and 150-161, average 155, in females; subcaudals 43-62, average 52, in males, and 35-58, average 44, in females.

Body light yellowish brown above, except on top of head; latter black above, the color extending posteriorly on 2-4 scale rows onto nape, there terminating with a V-shaped (with the apex posteriorly) extremity; belly whitish.

Size small, maximum recorded total length 13¾ inches; tail approximately 20 percent of total length.

Recognition Characters.—See discussion of *T. gracilis.*

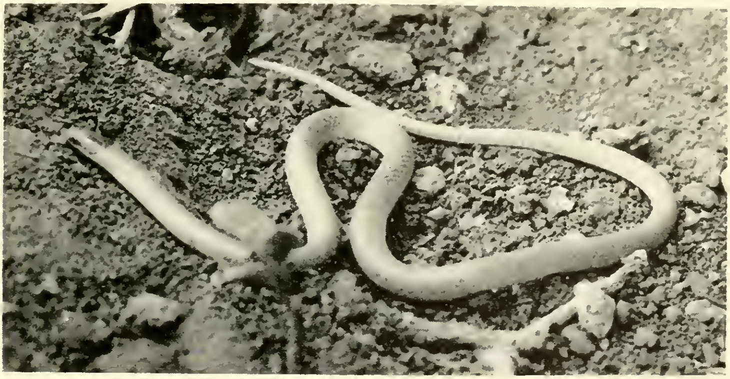


FIG. 204. A black-headed tantilla, *Tantilla n. nigriceps*, × ⅔, Congress Junction, Arizona. Courtesy H. K. Gloyd.

Habits and Habitats.—Specimens taken in Riley County were found under stones at the crest of the barren, grassy hills in only one restricted area south of Manhattan. Seemingly identical hillsides elsewhere in the vicinity of Manhattan harbored *T. gracilis* in quantity, but no *T. nigriceps.* The distribution of this form probably is spotty. Its habits are not known to differ from those of *T. gracilis.*

Kansan Subspecies.—One subspecies, *Tantilla nigriceps nigriceps* Kennicott, occurs in Kansas. The only other subspecies recognized at present occurs in south-central Texas, and adjacent parts of Mexico.

References.—Blanchard, 1938: 372, 376 (diagnosis); Taylor, 1936: 342-344, fig. 3 (variation).

Genus *Hypsiglena* Cope

Spotted Night Snake

Hypsiglena torquata (Günther)

Leptodeira torquata Günther, Ann. Mag. Nat. Hist., ser. 3, vol. 5, p. 170 (type locality—Laguna Island, Nicaragua).

Hypsiglena torquata Cope, Bull. U. S. Nat. Mus., no. 32, 1887, p. 78.

Range.—Western half of state along its southern border. Recorded only from 2 localities in Clark County (2 miles south of

State Lake, and Stevenson Ranch), and two in Barber County (6 miles southwest of Sun City, and 4 miles south of Aetna).

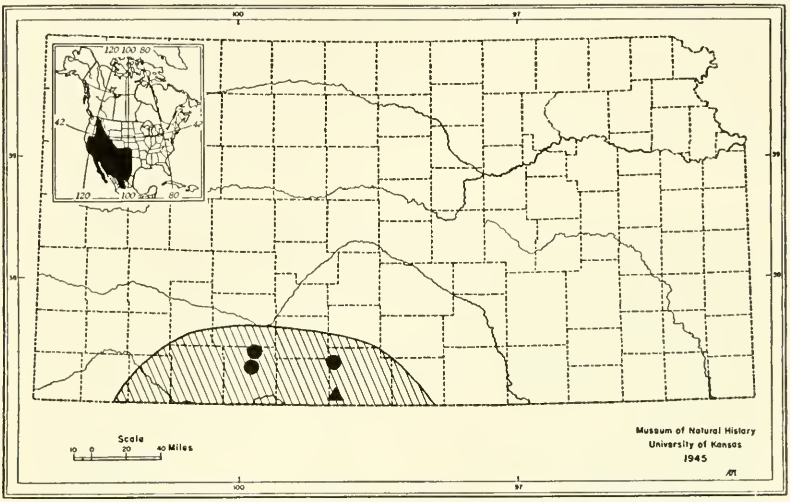


FIG. 205. Distribution of the spotted night snake, *Hypsiglena torquata*, in Kansas, with insert showing range of the species.

Description.—Head flattened, pointed, distinctly wider than neck; head scales much as shown in Fig. 150; 1-3, usually 2, preoculars; 2 postoculars; usually 1, sometimes 2, anterior temporals; usually 2, sometimes 1, posterior temporals; 7-9, usually 8, supralabials; usually 10, sometimes 9, infralabials; pregenials about equal in size to postgenials. Dorsal scales absolutely smooth; anal plate and subcaudals divided; scales in 21 or occasionally 23 rows at middle of body, 15 or 17 immediately in front of anus; ventrals 160-199, subcaudals 38-66. Pupil of eye vertical when examined during the day (that is, in light).

Ground color yellowish white, sprinkled with minute flecks of dark color; a series of 49-70 dark dorsal blotches on body, 10-12 scale rows broad, wider than long and sometimes placed diagonally and even broken into two spots by a split along the median line; 2-4 rows of smaller spots alternating with each other and with the dorsal series, on either side; 3 rather large spots on nape, including an elongate median spot and a larger lateral one on either side; latter spots continuous or in line with a dark band on side of head passing through eye and bordered above by a distinct white line; lips whitish, stippled; belly immaculate, under side of tail sometimes flecked with gray.

Size rather small, total length reaching 20½ inches; tail 13-16 percent of total length.

Recognition Characters.—The 21 (or 23 at middle of body) smooth scale rows and divided anal are, in combination, absolutely distinctive of this species in Kansas. Note also the vertical pupil.

Habits and Habitat.—This snake is found to be active only at night and the shape of the pupil (a vertical slit) in the light is additionally indicative of nocturnal habits. It is most often found under stones during the day, but at night wanders about on the ground. Arid and semiarid, particularly rocky areas, are inhabited; open terrain without cover such as rocks and other debris on the surface of the ground seemingly is avoided. This species lays eggs.

The food is known to include small lizards. A pair of slightly enlarged teeth at the rear of the upper jaw lacks any connection with poison ducts, but the saliva of this species is known to be mildly poisonous to lizards; it has little or no effect upon man and other large warm-blooded vertebrates. The snakes are docile and do not often try to bite; they are so small that the small teeth can do almost no damage to any but the smallest creatures.

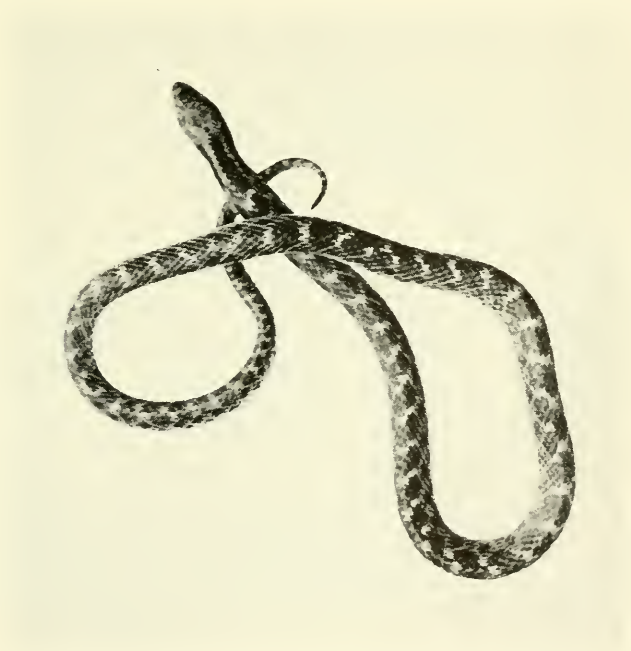


FIG. 206. A spotted night snake, *Hypsiglena torquata texana*, × ½, from Palo Pinto, Texas. Courtesy A. A. and A. H. Wright.

This species, members of the genus *Tantilla*, and the deadly venomous pit vipers are the only venomous snakes in the state; all others are completely harmless, and of course *Tantilla* and *Hypsiglena* are absolutely harmless so far as man is concerned.

Kansan Subspecies.—One subspecies, *Hypsiglena torquata texana* Stejneger (with type locality "between Laredo and Camargo, Texas"), occurs in Kansas. Ten other subspecies occur in the western United States and Mexico.

References.—Van Denburgh, 1922: 779-783, pl. 85 (description, distribution); Tanner, 1944: 51-54 (description, taxonomy).

Genus *Natrix* Laurenti

Yellow-bellied Water Snake

Natrix erythrogaster (Forster)

Coluber erythrogaster Forster, in Bossu, Travels Through That Part of North America Formerly Called Louisiana, vol. 1, 1771, p. 364 (type locality—restricted by Conant to Parker's Ferry, Edisto River Swamp, Charleston Co., South Carolina).
Natrix erythrogaster Clay, Copeia, 1938, no. 4, pp. 181-182.

Range.—Southeastern half of state. Recorded as far west as Seward (12 miles northeast of Liberal), Ford, Stafford (Salt Marsh), Dickinson (Abilene) and Doniphan (Doniphan Lake) counties.

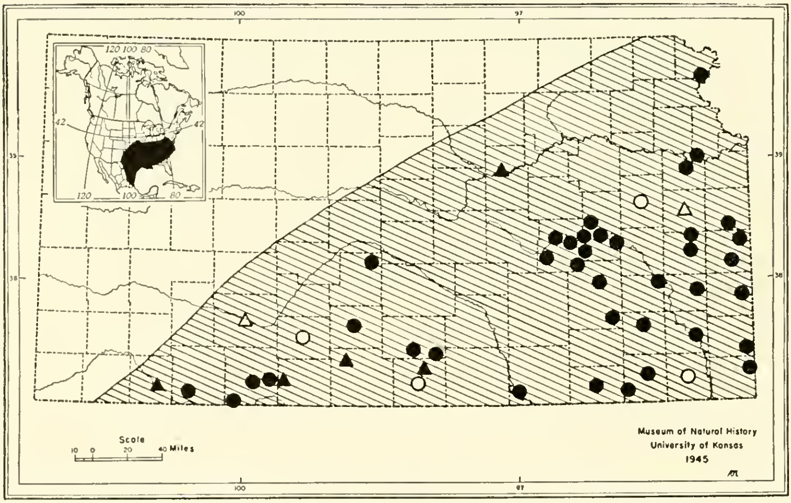


Fig. 207. Distribution of the yellow-bellied water snake, *Natrix erythrogaster*, in Kansas, with insert showing range of the species.

Description.—Head flattened, wider behind than in front, distinctly wider than neck; head scales much as in Fig. 150; 1 preocular; 3 postoculars; 2-3 posterior temporals; supralabials generally 8; infralabials generally 11. All dorsal scales keeled, the dorsal most strongly keeled; scale rows generally 25, sometimes 23, at middle of body, 17 immediately in front of anus; anal plate and all subcaudals divided; ventrals 143-157; subcaudals 62-83.

Thirty-two to forty rectangular blotches along middle of back in young and half-grown individuals; another lateral series of blotches, alternating with the dorsal blotches as far forward as head or second or third dorsal blotch; belly whitish, with anterior margins of ventrals, especially toward sides of belly, black or gray. These markings becoming less distinct in large specimens, and belly becoming lighter, so that in some the belly is uniform yellow or whitish, unmarked or only dimly clouded, whereas dorsal surface is more or less uniform olive or gray-brown. Size large, total length reaching about five feet (the eastern race has been recorded as reaching 5 feet, 7½ inches); tail about twenty percent of total length.

Recognition Characters.—The members of the genus *Natrix* in Kansas can be recognized by the combination of keeled dorsal scales, a single anterior temporal, divided anal, and no fewer than nineteen scale rows at middle of body. The present species may be distinguished from the others of the genus by the absence of dorsal spots combined with an unmarked or only cloudy belly, or, in case the dorsal spots are present, by the fact that they alternate with the lateral spots *all* the way forward to the head, except sometimes one or two spots back of head, which may be fused with the dorsal blotches to produce three or fewer crossbands. The species *N.*

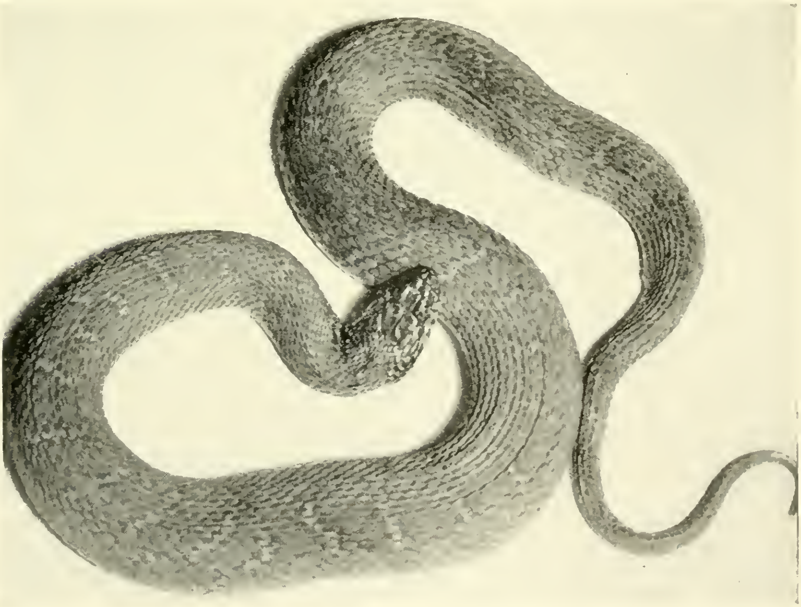


FIG. 208. A yellow-bellied water snake, *Natrix erythrogaster transversa*, × ⅖, K. U. no. 24395, 5 miles west of St. Paul, Neosho County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

erythrogaster is most often confused with *Natrix sipedon,* in which the dorsal spots are always visible, and more than three crossbands are present on the neck; in that species the belly is heavily mottled, whereas in *N. erythrogaster* the belly is unmarked or else the markings (visible only in young specimens) are restricted to the anterior edges of the belly scales. The subcaudals toward the tip of the tail are immaculate in *N. erythrogaster,* but mottled in *N. sipedon.*

Habits and Habitat.—Almost any permanent stream, river or lake harbors this species. It is nocturnal, and during the day can be found under stones and logs at the margin of the water. However on warm days the snakes emerge and bask for several hours in the sun, providing it is not too hot. All efforts to capture food, however, seem to be restricted to the evening.

The food is not constricted and probably consists of aquatic animals such as fish, frogs, crayfish, tadpoles and salamanders.

Like most other water snakes, these are extremely vicious, and do not become docile even in captivity except when special pains are taken not to arouse their fears. They strike repeatedly upon capture, and at the same time exude small quantities of an evil smelling fluid from the scent glands at the base of the tail. The teeth are long, numerous and sharp, and inflict numerous painful scratches. The snakes do not, however, like some others such as the racers, hold on and chew; they strike, bite and immediately let go.

Mating has been observed in the eastern subspecies in late April and May. No eggs are laid, but the females in September and October give birth to 8 to 27 young measuring 8⅝ to 10⅜ inches in length.

Kansan Subspecies.—Four races are recognized, one of which, *Natrix erythrogaster transversa* (Hallowell), occurs in Kansas. Its type locality is the "Creek boundary, near the banks of the Arkansas and its tributaries." The other races occur in the eastern United States.

References.—Conant, 1938: 70-74 (natural history of the eastern subspecies, *N. e. erythrogaster*); Schmidt and Davis, 1941: 224-225 (description, natural history); Cope, 1900: 973-975, fig. 252 (description); Conant, 1949: 12-14, pl. 1 in color (diagnosis, variation, comparisons).

Graham Water Snake

Natrix grahamii (Baird and Girard)

Regina grahamii Baird and Girard, Cat. N. Amer. Rept., 1853, p. 47 (type locality—Salado Creek, Bell County, Texas).

Natrix grahamii Cope, Proc. U. S. Nat. Mus., vol. 14, 1892, p. 668.

Range.—Eastern half of state. Recorded as far west as Jewell (Jewell) and Pratt (Pratt) counties; records sparse toward west.

Description.—Head small, narrower than body which tapers somewhat anteriorly, somewhat flattened above, and little wider than neck; head scales much as shown in Fig. 150; posterior temporals 2; supralabials 7, sometimes 8; infralabials 9-10; postgenials longer than pregenials. Dorsal scales strongly keeled, except those in outer row which are generally smooth; anterior scale rows 19 or 21, at middle of body 19, immediately in front of anus 17; anal and all subcaudals divided; ventrals 155-170; subcaudals 51-66.

More or less uniform brown above; a yellow stripe along either side involving 3 outer scale rows, with an irregular black border below which involves ends of ventrals and outer edge of first scale row; vague dark border on inner edge of light stripe; sometimes a feeble, dark-edged median light stripe; ventral surface immaculate or with one or two series of small dark spots; sometimes a median series of small spots under tail.

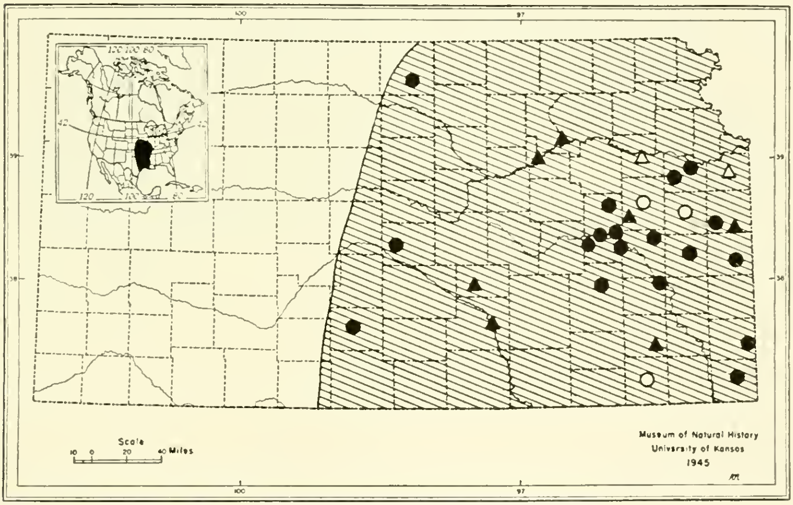


FIG. 209. Distribution of the Graham water snake, *Natrix grahamii,* in Kansas, with insert showing range of the species.

Size moderately large, total length reaching 29½ inches; tail about 16 percent of total length when complete (tip often missing).

Recognition Characters.—The striped pattern is distinctive of this peculiarly marked *Natrix.* It is the only species in the state combining nineteen scale rows at the middle of the body with a divided anal and keeled scales. *Tropidoclonion lineatum* looks much like the young of the present species, but has an entire anal and 2 rows of large spots down the belly.

Habits and Habitat.—In Nebraska these snakes have been found only near ponds. In Texas, where streams also are frequented, they have been found abundantly in crayfish burrows. The food consists largely of crayfish and to a lesser degree of other aquatic animals.

Ten to fifteen young measuring approximately eight inches in total length are born in late August and probably as late as September.

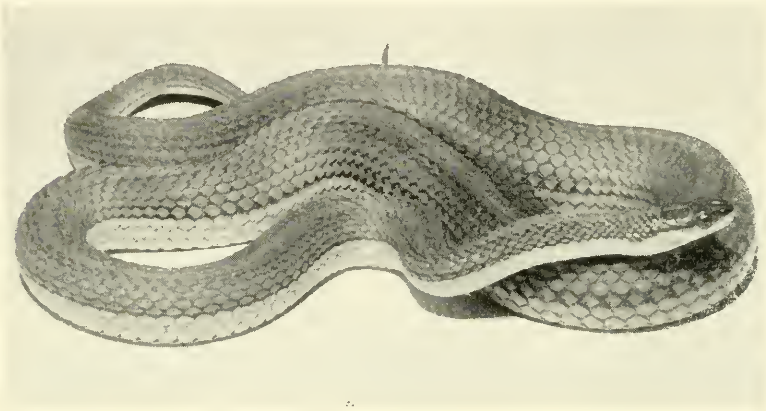


FIG. 210. A Graham water snake, *Natrix grahamii*, × ⅗, 7 miles southeast of Waco, McLennan County, Texas. Courtesy of the Zoölogical Society of Philadelphia.

Kansan Subspecies.—No subspecies have been distinguished anywhere in the range of this species.

References.—Hudson, 1942: 69-70, pl. 13, fig. 1 (description, habits, Nebraska); Schmidt and Davis, 1941: 210, fig. 67 (description, habits, general).

Diamond-backed Water Snake

Natrix rhombifera (Hallowell)

Tropidonotus rhombifera Hallowell, Proc. Acad. Nat. Sci. Phila., vol. 6, 1852, p. 177 (type locality—Tulsa, Oklahoma).

Natrix rhombifera Cope, Proc. U. S. Nat. Mus., vol. 11, 1889, p. 398.

Range.—Southeastern half of state. Recorded as far west as Meade (State Lake), Stafford (Salt Marsh), Lyon (5 miles northwest of Reading), Jefferson and Leavenworth counties.

Description.—Head flattened, large, wider than neck; head scales much as shown in Fig. 150; internasals narrow; 1 preocular or rarely 2; 3 postoculars or rarely 4 or 5; 2 posterior temporals; postgenials longer than pregenials; 7-11, generally 8, supralabials and 10-14, generally 11, infralabials. Dorsal scales strongly keeled, except those on sides which are weakly keeled; anal plate and all subcaudals divided; 25-29 scale rows at middle of body, 21-29 immediately in front of anus; ventrals 133-150, subcaudals 57-81.

Ground color light gray; a series of 30-64 small, dark gray blotches down middle of back on body, connected by narrow, sometimes indistinct, dark lines with similar, alternating dark spots in a row on each side; belly yellow; most ventral plates with several semilunar dark spots on their anterior edge.

Size large, reaching fifty-seven inches in total length; tail twenty to twenty-three percent of total length; body large and heavy.

Recognition Characters.—The members of the genus *Natrix* are characterized by the combination of keeled dorsal scales, a single anterior temporal, divided anal, and no fewer than 19 scale rows at middle of body. In the genus *Natrix*, *N. rhombifera* is set apart chiefly by its peculiar color-pattern, which is not duplicated in any other Kansan member of the genus or for that matter by any other snake in the state. The chief peculiarity of the pattern is the small size of the dorsal spots, and their connection with the small lateral spots by diagonal lines passing both forward and backward.

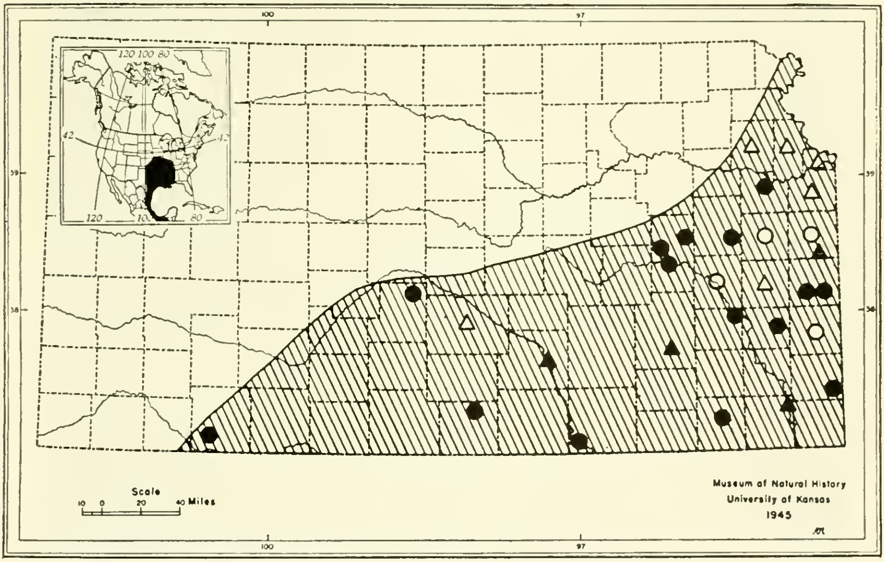


FIG. 211. Distribution of the diamond-backed water snake, *Natrix rhombifera*, in Kansas, with insert showing range of the species.

Habits and Habitat.—These, like other water snakes, are nocturnal although they enjoy basking in the sunshine for a part of each day. The basking, as in other species, is done on the branches of trees, on logs, rocks, or other promontories a few feet or a few inches above the surface of the water. Objects at the edge of the water may be used for basking, or objects projecting from it. When basking, they are not especially wary, and many individuals can be approached closely enough to be captured. At night when they are seeking food they are more wary but in shallow water can be captured easily. They strike and bite viciously, and their large size makes them the most feared of all the nonvenomous snakes in the state. The long teeth lacerate a person's flesh easily.

The food is much like that of other water snakes; items found in stomachs include catfish, small snapping turtles, sunfish, shad, frogs and other aquatic animals. The food can be, and probably often is, captured and swallowed under water; there is accordingly no foundation for the popular belief that snakes cannot strike under water.

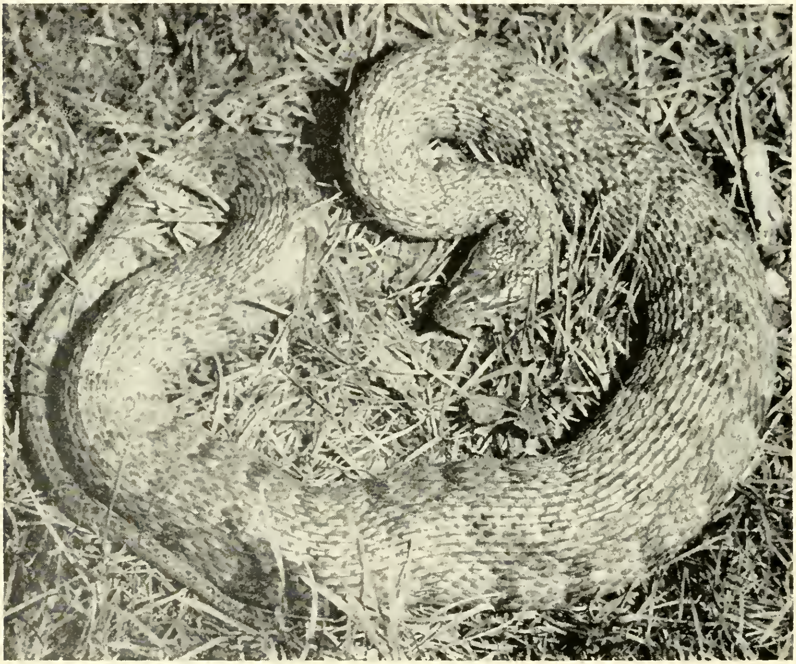


FIG. 212. A diamond-backed water snake, *Natrix r. rhombifera*, × ⅓, K. U. no. 24402, 5 miles west of St. Paul, Neosho County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Eighteen to forty-three, average thirty, young are born in late August and early September.

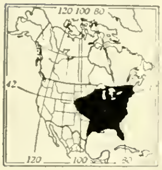
Kansan Subspecies.—Three subspecies have been defined; one, *Natrix rhombifera rhombifera* (Hallowell), occurs in Kansas. The other subspecies occur on the eastern coast of Mexico.

References.—Cagle, 1937: 179-185, pl. 1, text fig. 1 (variation, habits, Tennessee); Schmidt and Davis, 1941: 217-218, fig. 71 (description, natural history); Cope, 1900: 963-965, fig. 249 (description).

Common Water Snake

Natrix sipedon (Linnaeus)

Coluber sipedon Linnaeus, Syst. Nat., ed. 10, vol. 1, 1758, p. 219 (type locality—New York, New York).
Natrix sipedon Kirsch, Bull. U. S. Fish Comm., vol. 14, 1895, p. 333.



Range.—State-wide except for extreme southwestern corner. Recorded as far west as Phillips, Rooks, Logan and Meade (State Park) counties. Not recorded from northwestern corner but to be expected.

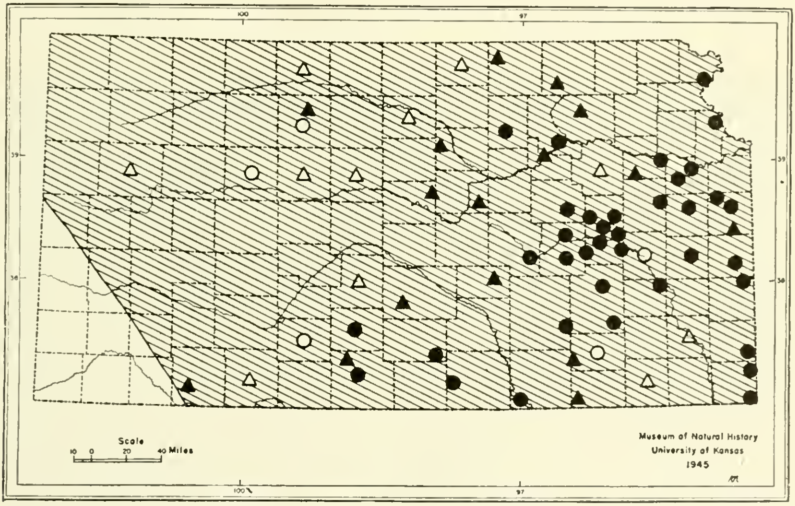


FIG. 213. Distribution of the common water snake, *Natrix sipedon*, in Kansas.

Description.—Head flattened, broader than neck; head scales much as shown in Fig. 150; internasals somewhat narrowed anteriorly; 1 preocular; 3 postoculars; supralabials generally 8, seldom 9; infralabials 9-11, generally 10; postgenials longer than pregenials. Dorsal scales strongly keeled, those on sides weakly keeled; scale rows on anterior ⅔ of body 21-23, immediately in front of anus 17-19; anal and all subcaudals divided; ventrals 132-149, average 140; subcaudals 66-82, average 75, in males, and 56-74, in females, average 64.

A series of 24-50 quadrangular blotches on body, the anterior four or more (average 10) crossbarlike, fused with lateral spots on either side; back of the level of the crossbands, lateral spots alternate with dorsal spots; ground color gray or olive; belly usually rather brightly marked with various hues from dark gray to orange, the darker markings tending to be semilunar in shape and scattered more or less irregularly over the belly; tail similarly, densely marked.

Size rather large, total length reaching fifty-one inches; tail twenty to twenty-nine percent of total length.

Recognition Characters.—Members of the genus *Natrix* in Kansas may be recognized by the combination of keeled dorsal scales, a single anterior temporal, divided anal, and no fewer than nineteen scale rows at middle of body. *N. sipedon* may be distinguished from other species of the genus by the presence of four or more broad crossbands on the anterior part of the body. It is most often confused with *N. erythrogaster,* which has immaculate caudals at the tip of the tail, an unmarked belly or belly with marks only at the anterior margin of the ventrals, and no more than three complete crossbands on the neck. See discussion of *N. erythrogaster.*

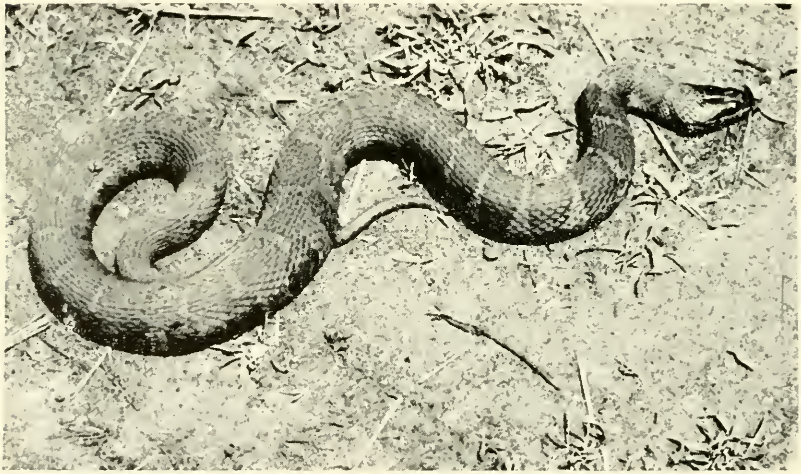


FIG. 214. A common water snake, *Natrix s. sipedon,* × ⅓, 2 miles south of Townsend, New Castle County, Delaware. Courtesy of the Zoölogical Society of Philadelphia.

Habits and Habitat.—The habits and habitat of this species are much like those of other *Natrix* in Kansas. It is, however, by far the most ubiquitous species of the genus in the state. It is the species commonly found about streams, rivers, marshes, permanent ponds and lakes. At times the snakes wander several hundred feet from water.

This and other species of *Natrix* have the very unpleasant habit of exuding the contents of the anal scent glands when captured, while the tail and rear part of body flail about, scattering widely the evil smelling secretion, often mixed with copious quantities of feces.

Mating occurs in spring (April and May) and perhaps also in fall

(September). Ten to seventy-six young are born from August to October; the number varies with the size of the female; large females have large litters, and small females small litters. There is considerable evidence that any one female will bear young only in alternate years. When born the young measure nine inches in total length.

The food consists of aquatic animals, chiefly fish, frogs, salamanders and crayfish. Mammals rarely are eaten. Some of these snakes die as a result of being impaled on the spines of fins of catfish that they have swallowed.

Kansan Subspecies.—Eight subspecies are known, one of which, *Natrix sipedon sipedon* (Linnaeus), occurs in Kansas. The others occur in the eastern United States eastward from Texas.

References.—Conant, 1938: 81-86, pl. 11, fig. 1 (description, natural history, Ohio); McCauley, 1945: 106-114, fig. 28 (description, natural history, Maryland); Schmidt and Davis, 1941: 219-220, pl. 24 (description, natural history).

Genus *Storeria* Baird and Girard

DeKay Snake

Storeria dekayi (Holbrook)

Tropidonotus dekayi Holbrook, N. Amer. Herp., ed. 2, vol. 4, 1842, p. 53, pl. 14 (type locality—Cambridge, Massachusetts).
Storeria dekayi Baird and Girard, Cat. N. Amer. Rept., 1853, p. 135.

Range.—Eastern two-thirds of state. Recorded as far west as Graham and Kiowa (Rezeau Ranch) counties.

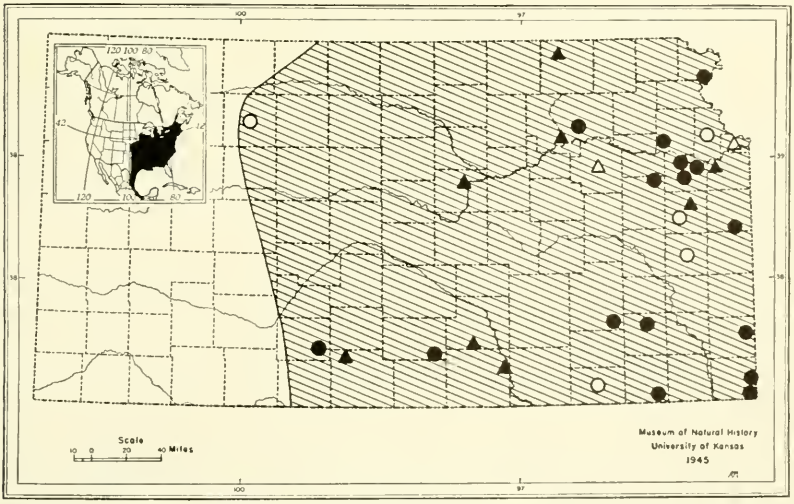


FIG. 215. Distribution of the DeKay snake, *Storeria dekayi*, in Kansas, with insert showing range of the species.

Description.—Head rather thick, slightly flattened above, a little wider than neck; head scales much as shown in Fig. 150; 1 preocular; 2 postoculars; 6-8, usually 7, supralabials and infralabials; 1 anterior and 2-3 posterior temporals; postgenials a little broader and longer than pregenials. Dorsal scales keeled, those in outer row rather feebly; scale rows 17 throughout length of body; anal and subcaudals divided; ventrals 121-131, average 125, in males, and 125-140, average 131, in females of this area; subcaudals 53-61, average 56, in males, and 41-51, average 46, in females.

Gray or olive above, sometimes uniform but usually with a dim middorsal light stripe some three scale rows wide; almost always evident is the series of small spots bordering the median stripe on either side; sides of belly finely stippled, venter otherwise whitish or slightly pinkish; a dark spot below eye and on either side of neck.

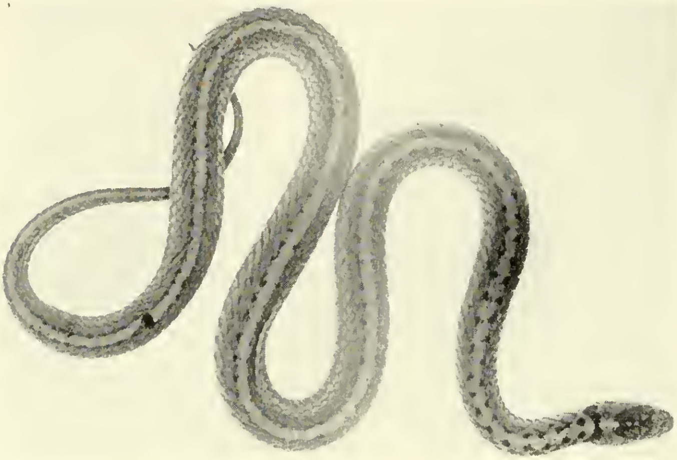


FIG. 216. A DeKay snake, *Storeria dekayi texana*, × 1, K. U. no. 23608, Lawrence, Douglas County, Kansas. Photo by E. H. Taylor and T. P. Lyle.

Size small, total length reaching 15 inches; tail 17-27 percent of total length.

Recognition Characters.—There is no obvious character distinguishing this species from others of the state. The combination of seventeen rows of keeled scales and a divided anal distinguishes the species from all others except *Opheodrys aestivus* (a larger snake with more than 100 subcaudals) and *Haldea* (which has 5 or 6 supralabials and no preocular). The dim, broad, middorsal light stripe combined with the small size are the two most useful characters for spot recognition, and for readily distinguishing this species from the other species of snakes with which it might be confused in Kansas. The absence of the loreal is a useful characteristic.

Habits and Habitat.—This apparently nocturnal species frequents moist situations, generally under rocks, logs or other cover in creek beds and in woods. It is completely innocuous, making no attempts to bite even with severe provocation; it does secrete a rather strong-smelling fluid from the anal glands at least when first captured. Even this defense is later dropped.

Slugs, snails and earthworms and but little else are taken as food.

In the eastern subspecies mating occurs in late March and April, and 3-24 young are born in July and August; at birth they measure 3½ to 4½ inches long.

Kansan Subspecies.—Six subspecies are known, of which but one, *Storeria dekayi texana* Trapido, occurs in Kansas. Its type locality is at Edge Falls, 4 miles south of Kendalia, Kendall County, Texas. The other subspecies occur in the eastern United States and eastern Mexico and Guatemala.

References.—Schmidt and Davis, 1941: 227-228, pl. 25 (description, natural history); Trapido, 1944: 63-79, figs. 45-50 (description, variation, distribution).

Red-bellied Snake

Storeria occipitomaculata (Storer)

Coluber occipito-maculatus Storer, Rep. Fish Rept. Birds Mass., 1839, p. 230 (type locality—Amherst, Massachusetts).

Storeria occipito-maculatus Baird and Girard, Cat. N. Amer. Rept., 1853, p. 137.

Range.—Eastern fifth of state. Records from Riley, Phillips (Long Island) and Hamilton counties require confirmation.

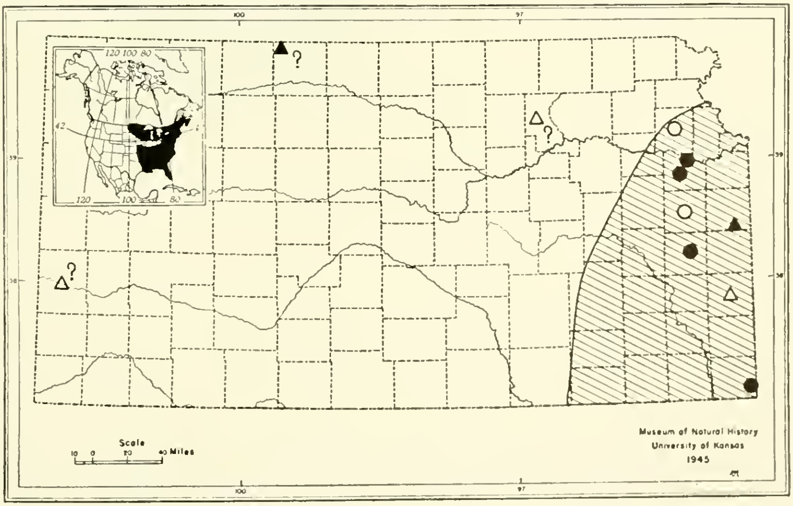


FIG. 217. Distribution of the red-bellied snake, *Storeria occipitomaculata*, in Kansas, with insert showing range of the species.

Description.—Head rather thick, slightly flattened above, a little wider than neck; head scales much as shown in Fig. 150; 2 preoculars; 2 postoculars; 1 anterior and 2-3 posterior temporals; usually 6 supralabials; usually 7 infralabials; postgenials a little shorter but wider than pregenials. Dorsal scales keeled except those in outer row; scale rows 15 throughout length of body; anal and subcaudals divided; ventrals 112-132, average 121, in males, and 121-133, average 125, in females of this area; subcaudals 42-55, average 49, in males, and 37-51, average 42, in females.

Dark gray or brown above, the color extending onto ends of ventrals; remainder of ventral surface whitish anteriorly, generally reddish posteriorly; 3 light spots back of head on nape, and one on side of head below and behind eye.

Size small, maximum total length recorded 15 inches; tail 17-29 percent of total length.

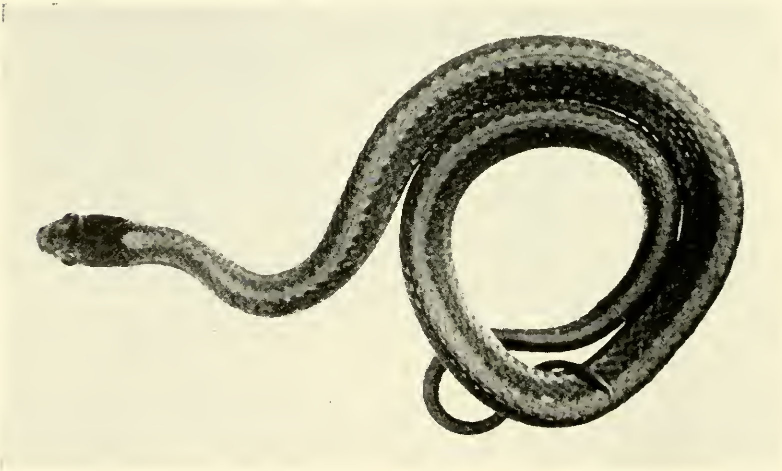


Fig. 218. A red-bellied snake, *Storeria o. occipitomaculata*, × 1, K. U. no. 23690, 5½ miles east of Baxter Springs, Cherokee County, Kansas. Photo by Mrs. Virginia C. Unruh and T. P. Lyle.

Recognition Characters.—No other species in the state has fifteen keeled scale rows.

Habits and Habitat.—This species, like *S. dekayi*, is restricted to moist areas, where it is found under boards, stones, logs and other surface debris. It is completely harmless and refuses to bite, although an interesting reaction has been noted by McCauley in Maryland: the snakes sometimes, when first discovered, rear backward and curl the upper lip outward, turning the upper jaw bone (maxillary) outward at the same time; the action is reminiscent of the "showing of teeth" practiced by some mammals for purposes of intimidation. The reaction has been noted by Conant in *Haldea valeriae* also.

The food consists of earthworms, slugs and small insects.

The young are born from July to September in litters of 1-14, average 7, and measure upon birth 2⅝ to 3⅞ inches long.

Kansan Subspecies.—Three subspecies have been recognized in this species, only one of which occurs in Kansas; it is *Storeria occipitomaculata occipitomaculata* (Storer). The other subspecies occur in Florida and central Mexico.

References.—Schmidt and Davis, 1941: 229-230, fig. 74 (description, natural history); Trapido, 1944: 20-33, figs. 11-13, 20 (description, variation, distribution).

Genus *Haldea* Baird and Girard

Southern Ground Snake

Haldea striatula (Linnaeus)

Coluber striatulus Linnaeus, Syst. Nat., ed. 12, vol. 1, 1766, p. 375 (type locality—Charleston, South Carolina).
Haldea striatula Cope, Ann. Rep. U. S. Nat. Mus., 1898 (1900), p. 1009, fig. 272.

Range.—Extreme southeastern corner of state. Recorded only from Crawford (6 miles east of Pittsburg) and Cherokee (3 miles east of Crestline; 2 miles north of Baxter Springs) counties.

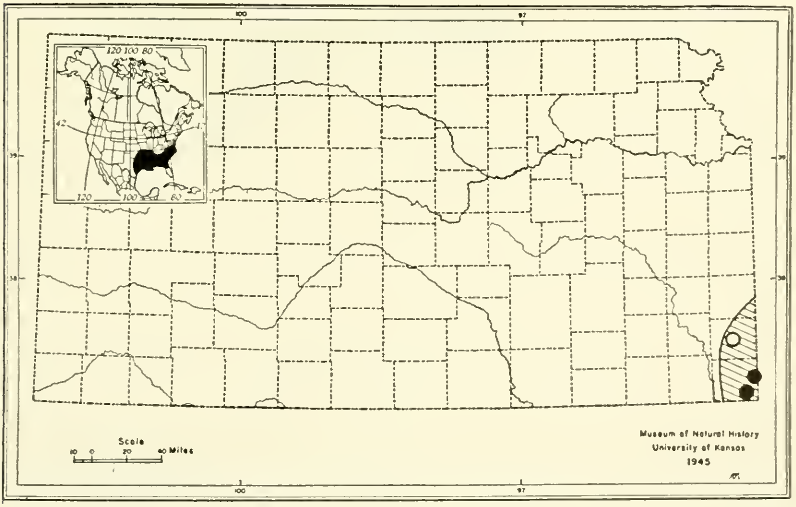


FIG. 219. Distribution of the southern ground snake, *Haldea striatula*, in Kansas, with insert showing range of the species.

Description.—Head small, thick, rather sharply pointed, not distinct from neck; head scales much as shown in Fig. 150; internasals fused, represented by a single plate (rarely 2); no preocular; loreal and prefrontal in contact with eye; 1 postocular; 1 anterior and 1 or 2 posterior temporals; supralabials 5; infralabials 6; postgenials as long as or a little shorter than pregenials. Dorsal scales keeled, except those in outer row, which are smooth; scale rows 17, occasionally reduced to 15 immediately in front of anus; anal plate and, with occasional exceptions of 1-10 scales, subcaudals divided; ventrals 120-135; subcaudals 36-50.

Dull gray or gray-brown above and yellow to pink below; head a little darker than body; no markings except (in eastern United States) sometimes a light band of varying distinctness across middle of parietals.

Size small, total length reaching twelve inches; tail approximately seventeen percent of total length.

Recognition Characters.—This is the only snake in the state that has the internasals fused together to form a single scale. Only one other species has five supralabials—*Carphophis amoenus*, but it has thirteen rows of smooth scales instead of seventeen rows of keeled scales.

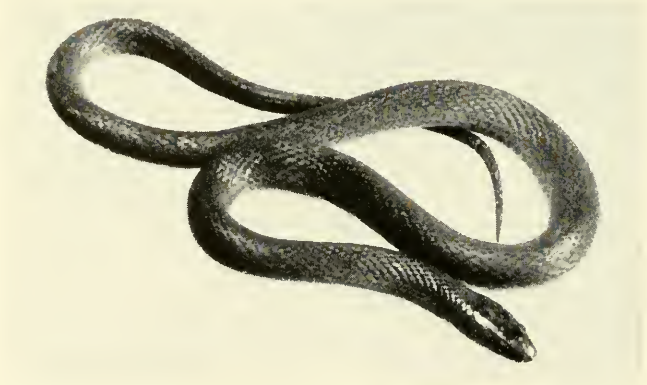


FIG. 220. A southern ground snake, *Haldea striatula*, × 1, Tulsa, Oklahoma. Courtesy H. K. Gloyd.

Habits and Habitat.—This is apparently a nocturnal species, found in the day hidden under logs, bark and leaves, and at night wandering about among leaves on the ground. It occurs in moist areas near streams or pools of water. In Texas the species was collected in large numbers by Edward H. Taylor by raking with the hands in leaves and other debris on the banks of long-deserted gravel pits where small trees and other vegetation provided considerable shade during the day; more open spots were avoided.

The food consists of insects, their larvae, earthworms, spiders and other small invertebrates.

The young are born in litters of six to eight, and each measures approximately four inches in total length.

Kansan Subspecies.—No subspecies have been defined anywhere in the range of this species.

Reference.—Schmidt and Davis, 1941:231-232, fig. 75, pl. 25.

Western Ground Snake

Haldea valeriae (Baird and Girard)

Virginia valeriae Baird and Girard, Cat. N. Amer. Rept., 1853, p. 127 (type locality—Kent County, Maryland).

Haldea valeriae Stejneger and Barbour, Check List N. Amer. Amph. Rept., ed. 4, 1939, p. 132.

Range.—Eastern border of the state. Recorded only from Leavenworth (15 miles northeast of Lawrence), Jefferson (10 miles north of Lawrence, Douglas (Lawrence), Franklin (Ottawa) and Anderson counties.

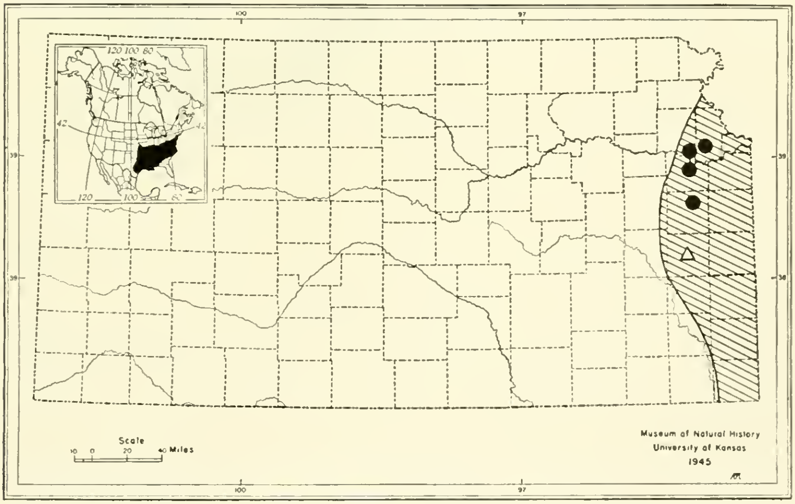


FIG. 221. Distribution of the western ground snake, *Haldea valeriae,* in Kansas, with insert showing range of the species.

Description.—Head little flattened, pointed, scarcely distinguished from neck; head scales much as shown in Fig. 150; no preocular; loreal and prefrontal in contact with eye; 1-3, generally 2 postoculars; 1 anterior and 2 posterior temporals; 6 supralabials; 6 infralabials; postgenials two-thirds length of pregenials. Dorsal scales keeled except those in 1 or 2 lateral rows; generally 17 scale rows throughout length of body; anal and all subcaudals divided; ventrals 113-131; subcaudals 25-45.

Olive above, sometimes suffused with pink; belly whitish; a faint middorsal light streak sometimes evident, bordered on either side by a series of tiny black flecks.

Size small, maximum total length measurement recorded, 12½ inches; tail 13 to 21 percent of total length.

Recognition Characters.—Only two other species in the state lack a preocular: *Carphophis amoenus* (13 rows of smooth scales) and *Haldea striatula* (1 internasal, 5 supralabials).

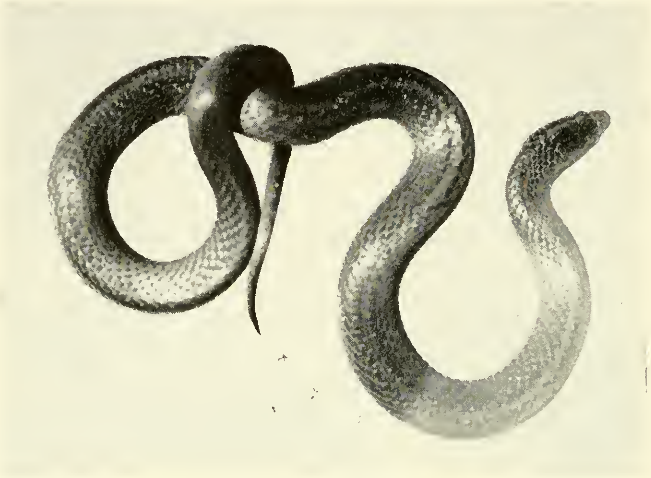


FIG. 222. A western ground snake, *Haldea valeriae elegans*, × 1, San Antonio, Texas. Courtesy H. K. Gloyd.

Habits and Habitat.—These are nocturnal, terrestrial snakes which live in wooded areas where they hide beneath stones, logs and other surface cover.

In the eastern subspecies, in August, 4-8 young are born, each approximately 2½ inches in length.

The food consists of earthworms, insects and their larvae. In captivity the snakes are said to feed well upon earthworms.

Kansan Subspecies.—Two subspecies are known, one of which, *Haldea valeriae elegans* (Kennicott), occurs in Kansas. Its type locality is "heavily timbered regions of southern Illinois." The other subspecies occurs in the eastern United States.

References.—Conant, 1938: 94-96, and McCauley, 1945: 119-121 (habits of the eastern subspecies, *H. v. valeriae*, Ohio and Maryland, respectively); Schmidt and Davis, 1941: 232-233, fig. 76 (description).

Genus *Thamnophis* Fitzinger

Marcy Garter Snake

Thamnophis marcianus (Baird and Girard)

Eutaenia marciana Baird and Girard, Cat. N. Amer. Rept., 1853, p. 36 (type locality —Slough Creek, east of Hollister, Tillman County, Oklahoma).
Thamnophis marcianus Ruthven, Bull. U. S. Nat. Mus., no. 61, 1908, p. 58.

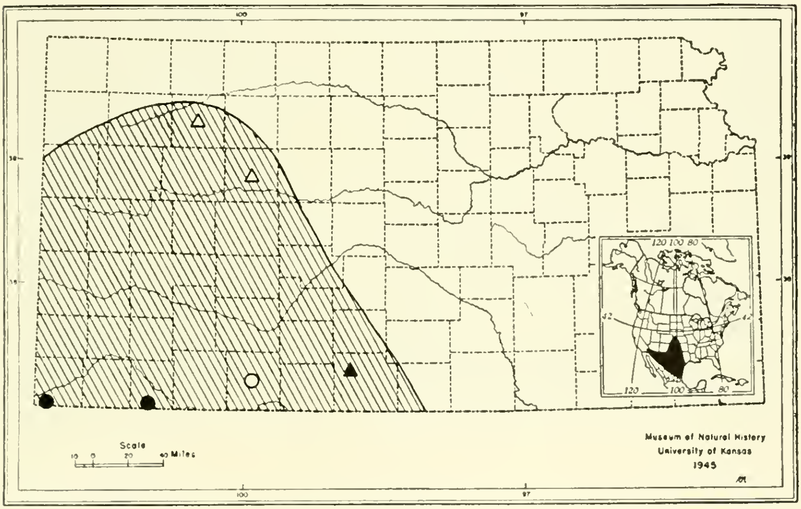


FIG. 223. Distribution of the Marcy garter snake, *Thamnophis marcianus*, in Kansas, with insert showing range of the species.

Range.—Western third of state seemingly not reaching the Nebraska border. Recorded as far east as Sheridan, Trego and Barber (Lake City) counties.

Description.—Head somewhat flattened, distinctly wider than neck; head scales much as shown in Fig. 150; 1 preocular; 3-4 postoculars; 2 posterior temporals; generally 8 supralabials, infralabials 9-11, most frequently 10; postgenials narrower but as long as pregenials. Dorsal scales keeled, those in outer row feebly if at all keeled; scales in 21 rows at middle of body, 17 immediately in front of anus; anal entire; subcaudals divided; ventrals 144-165, subcaudals 62-79.

Ground color brownish yellow; a middorsal light stripe covering 1 scale row and a half of each adjacent row, the edges irregular and not sharply defined; a lateral light stripe on the third scale row only anteriorly, the second and third posteriorly; none of the light stripes particularly well defined; between these stripes on either side two series of small, dark, alternating spots, sometimes poorly defined; another series of ill-defined spots below lateral light stripe, encroaching on ends of ventrals; belly yellowish, unspotted;

upper labials strongly barred; well-defined, light, crescent-shaped mark, followed by a dark mark, behind angle of jaws.

Size moderate, total length reaching 28⅝ inches; tail 19 to 26 percent of total length.

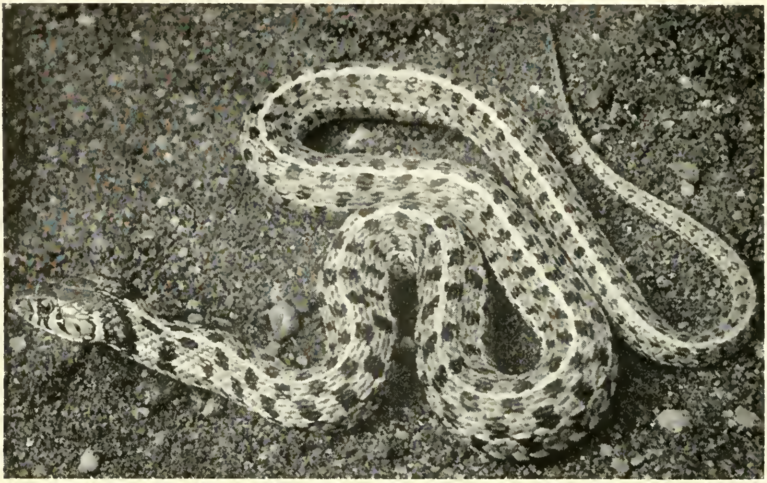


FIG. 224. A Marcy garter snake, *Thamnophis m. marcianus*, × 3/5. Courtesy of the New York Zoölogical Society.

Recognition Characters.—The garter snakes (*Thamnophis*) may be distinguished from all other snakes in Kansas except *Pituophis* (which has an enlarged rostral and 4 prefrontals) and *Tropidoclonion* (which has 6 supralabials) by the combination of keeled scales and an entire anal. Most easily confused with it is the species *Natrix grahamii* (*Natrix* has a divided anal), *Storeria* (also with a divided anal) and *Tropidoclonion*; these are the only other striped snakes in the state. The species differs from others of the genus in the restriction of the lateral light stripe to the third scale row anteriorly; in all others it involves the fourth and second row also. Likewise characteristic, although not unique, is the absence of sharply defined, straight edges on the middorsal stripe, and the presence of a crescent-shaped mark back of the head on either side.

Habits and Habitat.—This species occurs only in semiarid regions, but like other garter snakes frequents the margins of pools of water and of streams and rivers. The food probably consists of frogs, toads and fish, as well as some invertebrates.

Little is known of the life history of this species. It, like other garter snakes, gives birth to living young; a litter of fourteen has been recorded. Litter size probably varies with size of mother.

Kansan Subspecies.—Two subspecies are recognized. The western one, *Thamnophis marcianus nigrolateris* Brown, occurs in Kansas. Its type locality is at Tucson, Arizona.

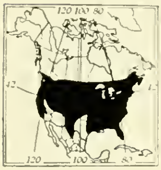
References.—Cope, 1900: 1044-1046, fig. 289 (description); Schmidt and Davis, 1941: 241-242 (description); Mittleman, 1949: 246-248.

Common Garter Snake

Thamnophis ordinatus (Linnaeus)

Coluber ordinatus Linnaeus, Syst. Nat., ed. 12, vol. 1, 1766, p. 379 (type locality—Charleston, South Carolina).

Thamnophis ordinatus Klauber, Copeia, 1948, no. 1, p. 9.



Range.—State-wide. Precise locality records are lacking for the entire northwestern third of the state, but records available from adjacent states reliably indicate occurrence throughout Kansas.

Description.—Head somewhat flattened, distinctly wider than neck; head scales much as shown in Fig. 150; 1 preocular; 2-4, usually 3, postoculars; 1 anterior and 1-3 posterior temporals; supralabials usually 7, occasionally 8; infralabials 9-11, usually 10; postgenials slightly longer than pregenials. Dorsal scales keeled; scale rows 19 on anterior two-thirds of body, 17 immediately in front of anus; anal entire; subcaudals divided; ventrals 156-178, average 163, in males, and 150-169, average 161, in females; subcaudals 76-95, average 83, in males, and 65-79, average 74, in females.

Three light stripes on body, lateral stripes not always well defined, involving second and third rows, middorsal stripe involving one full and two half scale rows; two series of alternating spots on either side between the stripes; spots in upper series generally fused with each other and with the spots in lower row; spaces between these spots reddish; a series of similar dark spots below lateral light line, separated by light areas suffused in part with red; belly gray or greenish, throat and under side of tail lighter; a series of small spots sometimes evident near ends of ventrals; lips barred or not, the markings quite variable.

Size moderate, total length reaching 45½ inches; tail 20-32 percent of total length.

Recognition Characters.—This is the only species of the genus *Thamnophis* (see discussion of *T. marcianus* for its distinctive characters) in Kansas which has the light lateral stripe involving the second scale row on the anterior part of the body; it is likewise the only one with the spots of the upper row fused with each other and with the spots of the adjacent row; and only one other species (rarely) has red in the dorsal coloration (*T. radix,* as an anomaly); ordinarily the presence of distinct red areas on the back can be

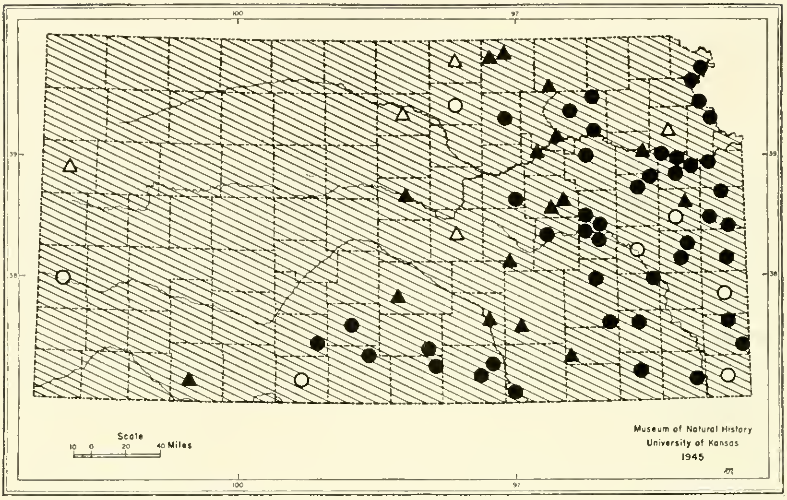

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FIG. 225. Distribution of the common garter snake, *Thamnophis ordinatus*, in Kansas.

relied upon as a criterion diagnostic of this species. If the specimen is emaciated, however, and the skin does not show between the scales, the red then may not be evident; the scales should be spread to determine the color of the skin if the red is not visible upon first glance. Preserved specimens tend to lose this color.

Habits and Habitat.—This is one of the most ubiquitous snakes of the state. It does not appear to be confined in particular to

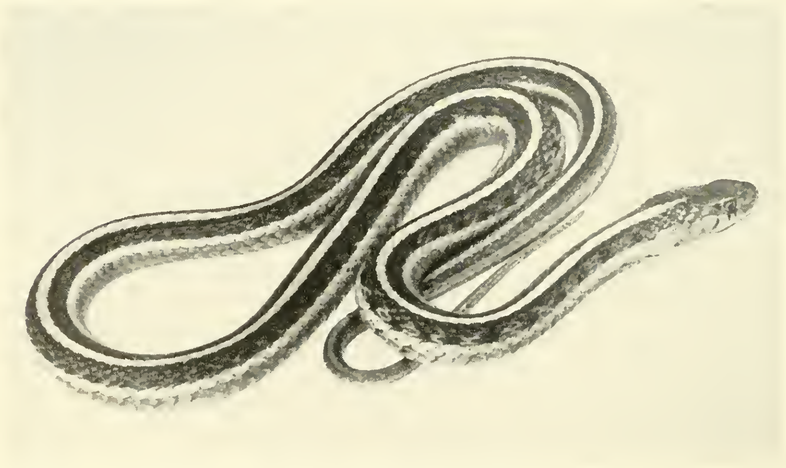


FIG. 226. A common garter snake, *Thamnophis ordinatus parietalis*, × ½, Derby, Colorado. Courtesy H. K. Gloyd.

aquatic habitats, although it occurs there in perhaps greater abundance than elsewhere. It is the common garter snake in towns, where it may be found in vacant lots and overgrown yards.

This, like other garter snakes, is a diurnal species seldom found at night, even under logs, stones or other cover where a person would expect to find it. Its temperament is like that of other garter snakes; that is to say, it is rather nervous and wary. Specimens bite when captured and void foul-smelling fluids from the anus; both reactions are inhibited in captivity. When startled, the snakes tend to flatten the body and spread the skin, thus exposing the red areas to full view. Certain other garter snakes have the same habit.

Earthworms, tadpoles, frogs and toads make up the bulk of the food of this species. Presumably carrion fish, small mammals and birds, are sometimes eaten.

Mating occurs in May in Maryland (in a different subspecies than that of Kansas), and 14-78 young measuring 6 to 8 inches in total length are born in August and September.

Kansan Subspecies.—Eight subspecies are recognized at the present time, one of which, *Thamnophis ordinatus parietalis* (Say), occurs in Kansas. The type locality is the same as that for *T. sauritus proximus.* The other races occur throughout the United States and in southern Canada and extreme northern Mexico. This species has been referred to as *T. sirtalis* (Linnaeus) for much of the past forty years, although that name actually was based upon the ribbon snake. The name could be preserved for the present species by fiat decision of the International Commission on Zoological Nomenclature, as indicated in the latest checklist for the United States (Schmidt, 1953, p. 174), but this has not been done. Less confusion results in retention of the name *T. ordinatus,* actually the first to have been applied to this species. That name has never been applied commonly (if at all) to any other species, and has been of frequent usage in the past few years.

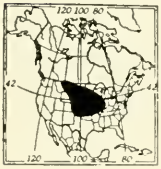
References.—Conant, 1938: 102-107, and McCauley, 1945: 124-128 (natural history, Ohio and Maryland, respectively, of a related form, *T. o. ordinatus,* there called *T. s. sirtalis*); Hudson, 1942: 78-80, pl. 14, fig. 2 (description, variation, habits, Nebraska); Schmidt and Davis, 1941: 253-255 (description, natural history).

Plains Garter Snake

Thamnophis radix (Baird and Girard)

Eutaenia radix Baird and Girard, Cat. N. Amer. Rept., 1853, p. 34 (type locality—Chicago, Illinois).

Thamnophis radix Jordan, Man. Vert. Anim. North. U. S., ed. 8, 1899, p. 193.



Range.—State-wide. Uncommon or rare in eastern quarter of state, and not recorded in the eastern corners, but records from adjacent states indicate that this species occurs in all parts of Kansas; abundance locally varies greatly.

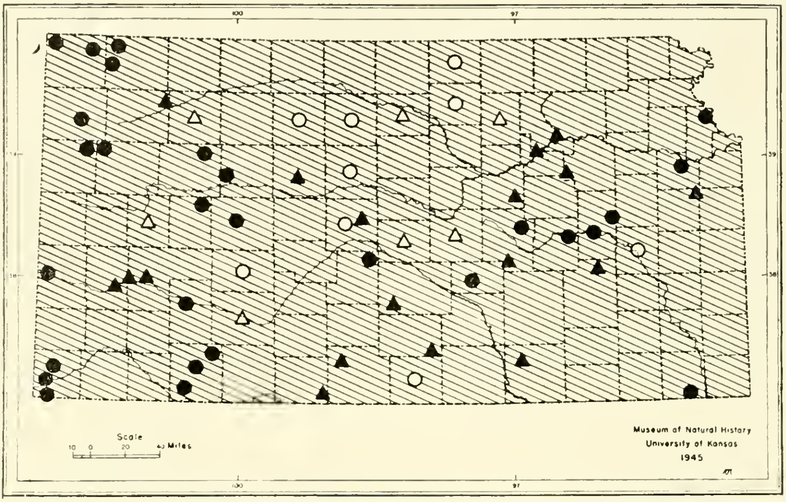


FIG. 227. Distribution of the plains garter snake, *Thamnophis radix*, in Kansas.

Description.—Head somewhat flattened, distinctly wider than neck; head scales much as shown in Fig. 150; 1 preocular; 2-4 postoculars, generally 3; 1 anterior and 2-3 posterior temporals; supralabials usually 7, sometimes 8; infralabials generally 9 or 10; postgenials slightly longer than pregenials. Dorsal scales keeled; 19-21 scale rows on anterior two-thirds of body, 17-19 immediately in front of anus; anal plate single; subcaudals divided; ventrals 142-176; subcaudals 73-87 in males, 56-75 in females.

Ground color greenish gray to light olive; a distinct middorsal stripe, generally yellowish in color, involving one full and two half scale rows and with straight, sharply defined edges; lateral light stripes, generally well defined, on adjacent edges of third and fourth scale rows anteriorly (on third or second and third posteriorly); two alternating series of spots on each side between stripes, and another series below lateral stripe; lips barred with black; belly whitish, the extreme anterior edges of ventrals black but the color showing chiefly at the edges of the ventrals, where the black expands somewhat to form a small black spot, and thus collectively a series of small black spots down each side of belly.

Size moderate, total length reaching 36 inches; tail 20-26 percent of total length.

Recognition Characters.—The genus *Thamnophis* in Kansas may be distinguished as indicated in the discussion of *T. marcianus*. From other members of the genus, *T. radix* may be distinguished most easily by the presence of the light lateral stripe upon the third and fourth rows anteriorly, combined with the presence of dark bars on the lips or a tail less than twenty-seven percent of the total length. The only other species with the lateral light stripe involving the fourth scale row is *T. sauritus,* but in this the lips are not barred and the tail is 25-37 (rarely less than 27) percent of the total length.

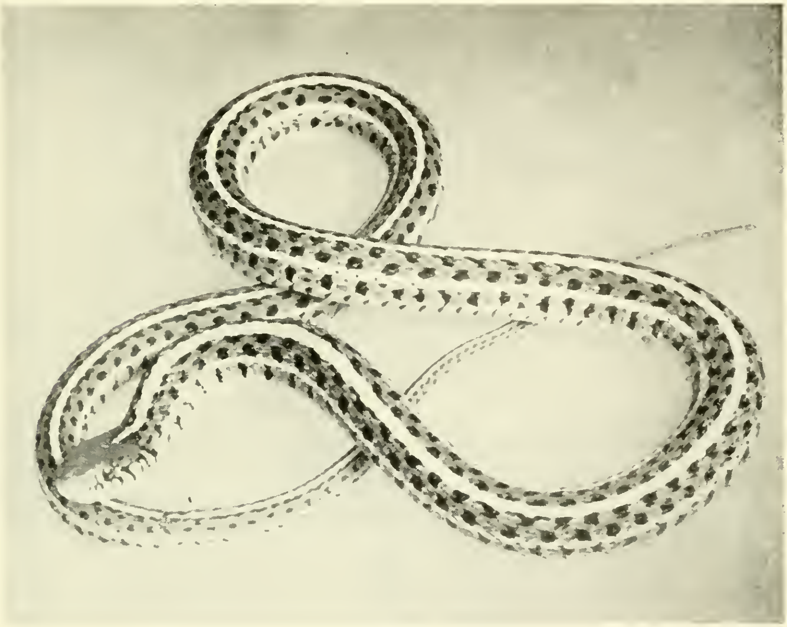


FIG. 228. A plains garter snake, *Thamnophis radix haydeni.* × ½. from Scott County, Kansas. Courtesy H. K. Gloyd.

Habits and Habitat.—This species is characteristic of the plains, where it is found most abundantly in marshy or swampy areas, along streams or other bodies of water. Snakes of this species do, however, wander far from water and may be found almost anywhere in fairly moist spots. They hibernate on land, in holes or ant hills several inches or feet below the surface of the ground. They are rather aggressive and usually attempt to bite upon capture; also they exude quantities of excreta and secretions from the postanal scent glands. After a time in captivity they become more docile, although never the dependable pets that some other kinds of snakes become. Plains garter snakes eat fairly readily in captivity, and may be fed upon earthworms, frogs and toads. These items form their natural food. Insects, tadpoles, fish and other aquatic or subaquatic animals are eaten.

Mating occurs in spring (April, May), and in late July through September litters of 13-40 young are born. At birth a young snake measures approximately 7 inches in total length.

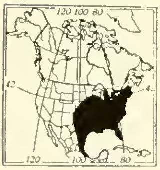
Kansan Subspecies.—Two subspecies are currently recognized in the range of this species. *Thamnophis radix haydeni* (Kennicott), with a type locality in Stanley County, South Dakota, is the subspecies occurring in Kansas. The other subspecies occurs to the east.

References.—Hudson, 1942: 75-77, pl. 13, fig. 5 (description, habits, distribution, Nebraska); Ruthven, 1908: 70-87 (variation, distribution); Schmidt and Davis, 1941: 250-251, fig. 80, pl. 26 (description, natural history); Smith (A. G.), 1949: 285-292 (variation, distribution).

Ribbon Snake

Thamnophis sauritus (Linnaeus)

Coluber saurita Linnaeus, Syst. Nat., ed. 12, vol. 1, 1766, p. 385 (type locality—Charleston, South Carolina, by restr.).
Thamnophis saurita Stejneger, N. Amer. Fauna, no. 7, 1893, p. 210.



Range.—State-wide, except perhaps the northwestern corner. Not recorded north of Wallace, Graham and Washington (6 miles east of Haddam) counties.

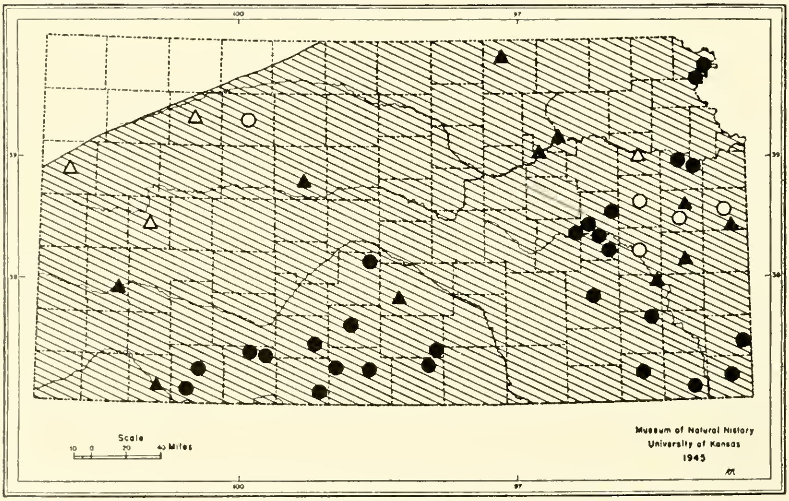


FIG. 229. Distribution of the ribbon snake, *Thamnophis sauritus*, in Kansas.

Description.—Head somewhat flattened, distinctly wider than neck; head scales much as shown in Fig. 150; 1 preocular; 2-3, usually 3, preoculars; 1 anterior and 1-2 posterior temporals; supralabials 8; infralabials 10; postgenials, slightly longer than pregenials. Dorsal scales keeled; scale rows 19 on anterior two-thirds of body, 17 immediately in front of anus; anal plate entire; subcaudals divided; ventrals 150-179; subcaudals 75-125.

Dark gray or black above, whitish below; a middorsal and 2 lateral light stripes, all well defined and with sharply defined, straight borders; lateral light stripes placed upon third and fourth scale rows, at least anteriorly, posteriorly dropping to the second and third rows; no discernible spots between or below stripes; lips completely immaculate, white; lateral edges of ventrals black; a pair of small, elongate, white spots on either side of the suture between parietal plates on head.

Size moderate, total length reaching 44 inches; tail 25-37 percent of total length; body relatively slender.

Recognition Characters.—When recognized as a member of the genus *Thamnophis* (see discussion of *T. marcianus*), this species can easily be distinguished from others of the genus by the combination of immaculate lips and a light lateral stripe on the third and fourth scale rows anteriorly. Only *T. radix* among other Kansas species of garter snakes has the stripe situated on the same rows, but in it the upper lips are strongly barred. The absence of spots between the stripes, and the presence of the small light spots on the middle rear part of the head are also distinctive, but not unique.

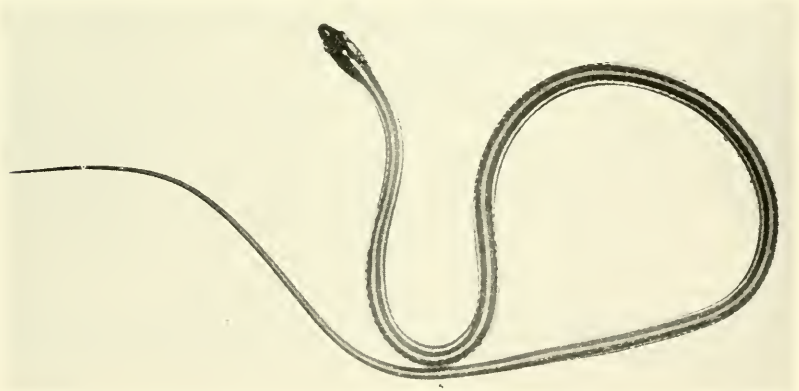


FIG. 230. A ribbon snake, *Thamnophis sauritus proximus*, × ½, K. U. no. 23688, 1½ miles east of Baxter Springs, Cherokee County, Kansas. Photo by Mrs. Virginia C. Unruh and T. P. Lyle.

Habits and Habitat.—This species is more often confined to the immediate vicinity of more or less permanent bodies of water than any other species of garter snake in the state. It is generally found along the shores of swamps, lakes and streams, especially where grass and other vegetation comes up to the water's edge. They are diurnal, like other garter snakes, and are frequently startled in grass as they search for food. They immediately retreat to the water, where they proceed to hide in vegetation or swim away. When captured they bite vigorously, and at the same time release the obnoxious secretions of the anal glands and excreta from the colon. Even after some time in captivity they remain somewhat nervous, although with careful treatment they refrain from use of their defense mechanisms. In captivity, they readily eat frogs, salamanders, small fish and probably small insects and earthworms. These items no doubt form their natural diet.

Mating probably occurs in spring, as in most other snakes. In July and August 5-20 young (less than in most other garter snakes) measuring about 9½ inches in total length are born.

Kansan Subspecies.—Four subspecies are recognized. The one which occurs in Kansas is *Thamnophis sauritus proximus* (Say). Its type locality is a stone quarry on the west side of the Missouri River, 3 miles above the mouth of Boyer's River, Iowa. The other subspecies occur in the eastern United States and southward along the Atlantic Coast of Mexico and Central America to Costa Rica.

References.—Conant, 1938: 99-102, and McCauley, 1945: 121-124 (habits and natural history of a related form, *T. s. sauritus*, in Ohio and Maryland, respectively); Hudson, 1942: 77-78, pl. 14, fig. 1 (description, habits, Nebraska); Schmidt and Davis, 1941: 256-257, fig. 82, pl. 28 (description, natural history).

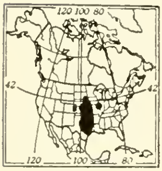
Genus *Tropidoclonion* Cope

Lined Snake

Tropidoclonion lineatum (Hallowell)

Microps lineatus Hallowell, Proc. Acad. Nat. Sci. Phila., 1856, p. 241 (type locality—Ft. Leavenworth, Kansas, by rest.).

Tropidoclonion lineatum Cope, Proc. Acad. Nat. Sci. Phila., 1860, p. 76.



Range.—All except the western border of the state. Recorded as far west as Rawlins (2 miles east of Atwood), Logan, Scott, Sedgwick (Wichita) and Cowley (4 miles southeast of Arkansas City) counties.

Description.—Head little flattened, pointed, no wider than neck, narrower than body which tapers anteriorly; head scales much as shown in Fig. 150; 1 preocular; 2 postoculars; 1 anterior and 2 posterior temporals; usually 5, sometimes 6 supralabials; infralabials 6 or sometimes 7; postgenials about half size of pregenials. Dorsal scales keeled except those in outer 1 or 2 rows on either side; scale rows in 17 rows on anterior one-third of body, 17 to 19 rows at middle of body, and 15-17 rows immediately in front of anus; anal entire; subcaudals divided; ventrals 138-146; subcaudals 29-45.

Ground color varying from dark to light gray; a poorly defined, light gray middorsal light stripe and a similar lateral stripe on either side involving the second and third scale rows; on a light ground color small black spots are evident bordering the light lines; belly whitish, with two rows (nearer midline than edges of ventrals) of rounded, well-defined, black spots, a pair of spots on each ventral.

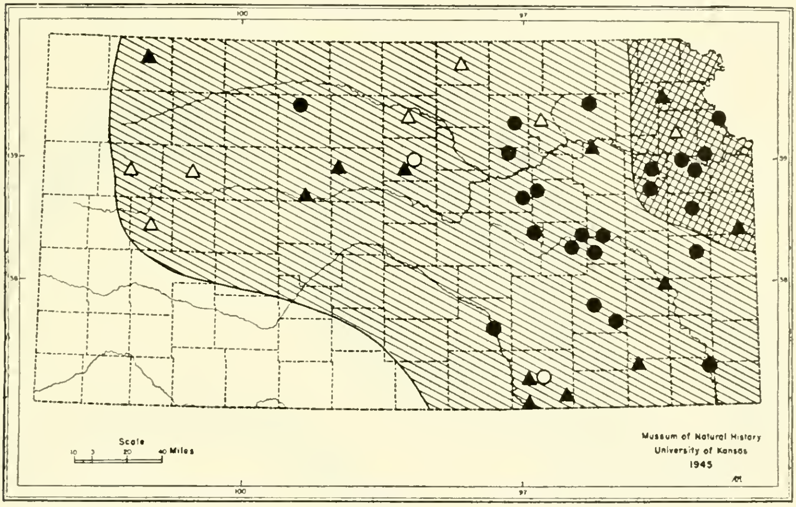


FIG. 231. Distribution of the lined snakes, *Tropidoclonion lineatum*, in Kansas. The range of *T. l. lineatum* is indicated by the crosshatched area, that of *T. l. annectens* by the single set of lines.

Size small, total length reaching 20 inches; tail about 13 percent of total length.

Recognition Characters.—The two rows of black spots down the middle of an otherwise unmarked belly is absolutely distinctive of this species in Kansas. Other species of snakes have rows of spots nearer the sides of the belly than its middle, but none has them so distinct and near the middle of the belly as does this species. It most closely resembles *Natrix grahamii*, which has a divided anal (entire in *Tropidoclonion*). Garter and ribbon snakes are superficially similar, but the former have seven or more supralabials.

Habits and Habitat.—These snakes are not infrequently found emerging in the day from hiding places under stones, logs, rock fences and other cover on the surface of the ground. They have been taken as late as early November in Kansas, when they took advantage of late warm spells to emerge from hibernation in a stone fence. Whether they are normally nocturnal or diurnal is unknown; they are said to forage at night, although they have been found moving about in the daytime. The food consists almost entirely of earthworms.

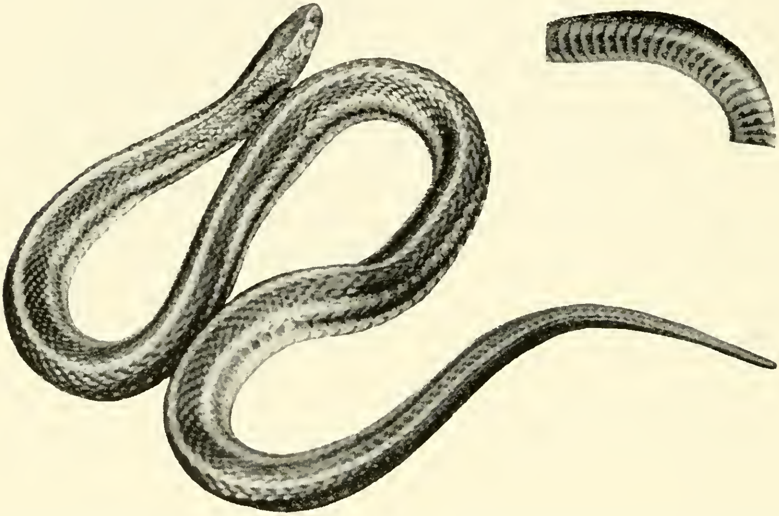


FIG. 232. Lined snake, *Tropidoclonion l. lineatum*. Lower left, × 1, Courtesy of the New York Zoölogical Society. Upper right, view of undersurface, midway between head and anus, from St. Louis, Missouri, × 1, by courtesy A. A. and A. H. Wright.

The snakes seldom if ever attempt to bite, but do thrash about and void copious anal excretions and secretions, much like their larger relatives, the garter snakes and water snakes.

The young are born in August in litters of 2-12 (usually 7 or 8).

Kansan Subspecies.—Three subspecies have been defined in the range of this species. Two occur in Kansas: *T. l. lineatum*, usually with less than 144 ventrals in females, 143 in males; and *T. l. annectens* Ramsey (type locality Tulsa, Oklahoma), usually with more numerous ventrals in both sexes.

References.—Hudson, 1942: 80-81, pl. 14, fig. 3 (description, distribution, Nebraska); Ramsey, 1947: 15-18 (interesting account of the feeding habits); Schmidt and Davis, 1941: 257-259, fig. 83, pl. 29 (description, natural history); Ramsey, 1953: 7-24, figs. 1-4 (taxonomy, geographic and structural variation, range maps, locality records).

The Pit Vipers

FAMILY CROTALIDAE

This family includes only those snakes provided with a facial pit between the eye and nostril. The pit functions as a detector of slight differences in temperature, so that the possessors of the organ can discern the presence of warm-blooded animals without seeing them. Since most species of these snakes hunt at night, and feed mostly upon small warm-blooded animals such as mice and birds, the advantage of such an organ is obvious.

The rattlesnakes, cottonmouths and copperheads belong to this family; they are the only representatives in the United States. Many other kinds occur in other parts of the world. The only other poisonous snakes in the United States are the coral snakes, which belong to the very different family Elapidae. They do not occur in Kansas.

The rattlesnakes are the most striking members of the family Crotalidae. They comprise a group occurring in the Western Hemisphere from Southern Canada to Brazil. They are not known in the Old World.

The rattle is a structure composed of a number of loosely jointed, horny segments which, when vibrated against each other produce a peculiar, characteristic sound. The snake when born has only a simple, blunt, "pre-button" at the end of the tail. When the skin is shed for the first time a few hours later, the rest of the first segment, or "button," of the rattle is formed. Thereafter the snake adds a new segment to the rattle each time it sheds. Shedding occurs two to four times a year, and accordingly the saying that a rattlesnake adds a rattle each year is a myth. The approximate age can be estimated, if the button is present, by dividing the total number of segments by three, which represents the average number of times per year a snake sheds its skin. Generally the series is incomplete, for the terminal rattles wear away until they drop off. A string of nine rattles is unusual, yet at least some rattlesnakes are known to live twenty or twenty-five years. Obviously the rattles wear away much too rapidly to permit age estimation by this method except for very young snakes.

Two genera of rattlesnakes are known. They differ chiefly in the size of the scales on top of the head: *Sistrurus* has large scales, *Crotalus* small ones. Both genera occur in Kansas.

All members of the family Crotalidae are deadly poisonous; all significantly poisonous snakes of Kansas belong to this family. They are provided with a pair of large, movable fangs (modified teeth) in the front of the mouth. When the mouth is closed the fangs are folded back against the roof of the mouth, but when the snake opens the mouth to bite or strike, the fangs may be rotated downward at will so that they project more or less straight downward. As the fangs penetrate, muscles contract about the poison glands at the rear of the head, forcing the venom through a duct leading to the fangs and finally through the fangs themselves into the bitten object. The fangs are hollow, much like a hypodermic needle, and have a fine opening at the free tip through which the poison passes to the exterior.

The poison of most members of this family affects the blood and any cells with which it comes into contact. Normally it is injected into spaces between the cells, and is slowly swept along in the lymphatic system toward the heart. As it is carried along it breaks down many cells, especially those of vessel walls, and thus contributes to the accumulation of a great deal of lymphatic ooze. Thus it is that considerable swelling occurs at the site of the bite of one of these snakes, and that the swelling accompanies the venom as it moves toward the heart. The venom breaks down the red blood cells as well as other cells, of course, and if death ensues it is brought about chiefly by the loss of too many red blood cells and resultant asphyxiation through the lack of the oxygen which these cells normally carry to the body tissues. If, by chance, the venom is injected directly into the big vessels of the blood circulatory system, it comes into immediate contact with many red blood cells; these are broken down rapidly and death may follow in a few minutes. The action is greatly slowed if the venom is injected into the spaces between the cells and is carried into the blood circulation by the slow movement of lymph. Fortunately, this is the way the venom is most often received.

It is obvious that any procedure slowing the rate of entrance of the venom into the blood circulatory system is so much to the good. For this reason loose tourniquets are applied, when possible, near the site of the bite—between it and the heart. As the swelling advances, the tourniquet should be advanced also, always a little ahead of the swelling.

Much pain and serious difficulties would be avoided if the victim of a bite would *immediately*—with the loss of not a fraction of a second—cut with a sharp knife or razor at the site of the bite, as deeply as the fangs penetrated, and then suck out all the blood, lymph and venom that can be extracted. The second or two after the bite is the most critical in the victim's chance for recovery; immediate suction may at once remove as much as seventy-five percent of the venom before it has a chance to diffuse in the tissues. Swift action may mean the difference between life and death, and certainly will reduce very greatly the hazards and pain in the victim's recovery. Care should be taken, of course, to avoid cutting large blood vessels. If one is cut the flow should be lessened as much as possible and the suction applied to one side of the spot.

First aid to the extent described should be in the mind of every one who is exposed to possible snake bite. Ordinarily the treatment just outlined is sufficient until the time when a doctor is reached. The steps to be followed have been summarized by Gloyd (1938: 9, 11) much as follows:

1. "Sterilize the skin over the area of the bite and with a sharp knife or razor blade, also sterilized, make cross cuts over each fang mark at least a quarter of an inch deep. Any standard antiseptic, such as iodine or mercurochrome, may be used for sterilization. If an antiseptic is not available, use the flame from a match.

2. "Do not run or do anything that will speed up circulation; do not use whisky or other forms of alcohol internally.

3. "Apply a tourniquet between the bite and the heart. Do not tie it too tight. Soft rubber tubing, such as that furnished with the various snake bite kits, makes the best tourniquet but a shoe string, handkerchief, or necktie will do.

4. "Apply suction to the incision. If the small rubber bulbs supplied with the kits for this purpose are not available, the mouth may be used. There is no danger if there are no cuts or sores in the mouth or on the lips. The venom must get into the blood stream to cause harm.

5. "Continue the suction, loosening the tourniquet every ten minutes for a few seconds. As swelling progresses the tourniquet should be moved and kept just above it, and just tight enough to retard, but not obstruct, the flow of blood in the veins. Great harm may result if it is too tight. It should be loose enough to allow a finger to be slipped under it easily.

6. "Get to a doctor or hospital as quickly as possible. Meanwhile continue suction.

7. "If antivenin is available, after about an hour of suction, inject five ampouls (50 cc.) directly into the bite and the sur-

rounding areas. An amount smaller than this, according to Doctor Jackson, is of no practical value.

8. "If antivenin has been given as above, wait one hour before resuming suction; otherwise continue the active suction treatment.

"By this time you should have reached a physician. If not, continue suction for at least fifteen hours.

"It should be strongly emphasized that a snake bitten person should be taken to a physician or hospital at once, if possible. Only a physician is qualified to meet emergencies that may arise during treatment."

It is perhaps worth emphasis that the bite of a copperhead or pigmy rattlesnake is not by any means as serious as that of the other pit vipers of the state. There is little chance that an untreated bite of either of these snakes would result fatally; only small children and persons in poor health would be in danger of losing their lives. If the simple first-aid directions are followed, virtually all chance of fatal results are eliminated. Such is not the case for the true rattlesnakes (*Crotalus*) nor for the cottonmouth. The bite of either of these can only be considered highly dangerous; only proper treatment will lessen the danger.

Genus *Ancistrodon* Beauvois

Copperhead

Ancistrodon contortrix (Linnaeus)

Boa contortrix Linnaeus, Syst. Nat., ed. 12, vol. 1, 1766, p. 273 (type locality—Charleston, South Carolina).

Agkistrodon contortrix Baird and Girard, Cat. N. Amer. Rept., 1853, p. 17.

Range.—Eastern third of state. Recorded from as far west as Marshall (Irving), Riley (Manhattan), Geary (Ft. Riley), Lyon (1½ miles northwest of Reading), Greenwood (Hamilton), and Cowley (1 mile south of Winfield) counties.

Description.—Head somewhat flattened, considerably wider than neck; nine large plates on top of head, in general as in most colubrid snakes (see Fig. 150); a large pit on side of head between nostril at tip of snout and eye; one loreal above pit; several preoculars, suboculars and postoculars, all forming a continuous series bordering eye except above, where the supraocular plate lies; several rows of temporals; supralabials 6-10, usually 8; infralabials 8-12, usually 10; postgenials absent. Dorsal scales keeled; 25 scale rows on anterior part of body, 23 at middle of body, usually 21 immediately in front of anus; anal plate and most subcaudals (all except a few at tip of tail) undivided; ventrals 140-157, average 148; subcaudals 37-54, average about 45, in both sexes.

Ground color various hues of brown, from light yellow-brown to dark gray-brown and bright red-brown; a series of 10-20 light-edged crossbands on body, each about one-half as wide at middle of body as at sides; ventrals whitish, mottled with dark brown, the most conspicuous markings of which are small spots coinciding with and alternating with the dorsal bands, and therefore twice as numerous as the dorsal bands; a narrow black line from eye to angle of jaws, fading into ground color above, sharply differentiated from clear yellowish lips below; a pair of black dots usually visible on middle of rear part of head, in the parietal plates. Tip of tail yellow in the young.

Size moderately large, the total length reaching a recorded maximum of 53 inches; tail 12-15 percent of total length.

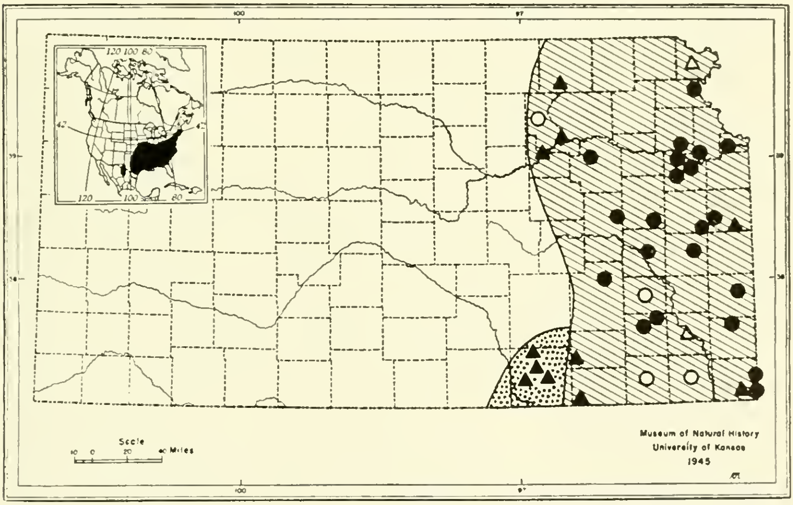


FIG. 233. Distribution of the copperhead, *Ancistrodon contortrix*, in Kansas, with insert showing range of the species. The range of *Ancistrodon contortrix mokeson* in the eastern part of the state is indicated by the lined area, and that of *Ancistrodon contortrix laticinctus* by the stippled area.

Recognition Characters.—Members of the genus *Ancistrodon* are easily recognized by the combination in them of nine large plates on top of the head (as in most colubrid snakes), no rattle, and a deep pit on side of head. Of other Kansas snakes, only rattlesnakes have the facial pit, but in them the rattle is present.

The cottonmouth and copperhead, the only members of the genus *Ancistrodon* in Kansas, are best distinguished by the presence of a loreal in *A. contortrix* and its absence in *A. piscivorus*. In the latter species, the large upper preocular is in contact with the nasal plate, whereas in *A. contortrix* these two plates are separated from each other by the loreal. *A. piscivorus* almost always has twenty-five scale rows, and *A. contortrix* twenty-three scale rows, but there is some variation in this character and thus some specimens would be erroneously identified by use of it. There are certain differences in pattern but they are so vague that no reliance should be placed upon them.

Habits and Habitat.—This species is found in wooded areas, generally on hillsides where rock is exposed. The snake is partial to the more moist eastern part of the state, avoiding the drier western portions. Extremely heavy woods are not inhabited, for there is insufficient penetration of the sun between the trees to warm the snakes in spring and fall. Except in spring and fall, however, when the snakes emerge for the warmth of the sun's rays, they are exclusively nocturnal. They have been found rather frequently near streams at night.

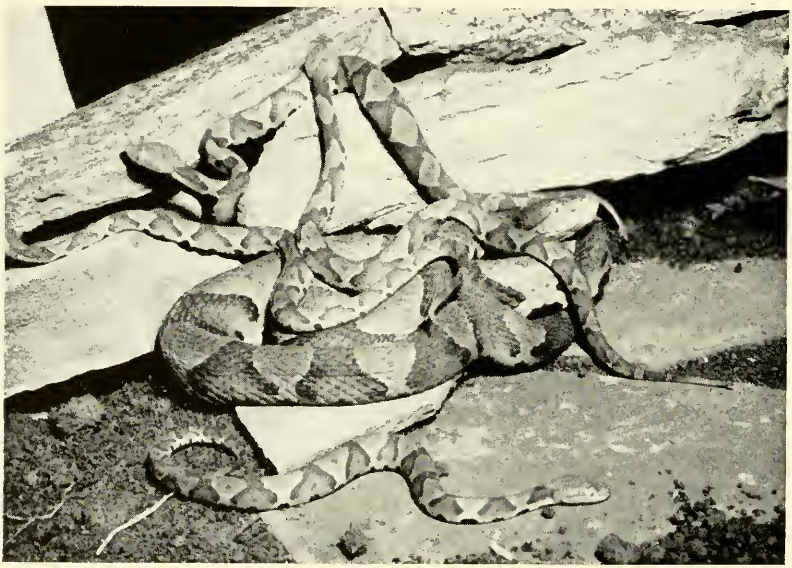


FIG. 234. Copperheads, *Ancistrodon contortrix mokeson*, × ⅓, Philadelphia, Pennsylvania. Courtesy of the Zoölogical Society of Philadelphia.

The food consists chiefly of mice, with occasional birds, and even large insects and larvae of insects. Larger prey is struck and released, and sought after its death, by use of the tongue and the heat-detecting organ, the pit. Smaller prey is held in the mouth until the poison of the venom has killed it. Items which do not need to be quieted before being swallowed are eaten without delay and without the use of the venom apparatus, except as the fangs are manipulated to help in the swallowing process. Most large items are swallowed head first.

All these snakes hibernate but choose relatively few dens for hibernation. Therefore, in spring, as they emerge from hibernation, they are concentrated in considerable numbers, and can easily be captured or killed. Later they disperse, or else emerge only at night, and can be found less readily. Throughout the year, however, some can be expected under stones and logs near the hibernation quarters. These snakes appear not to wander so far from their winter quarters as do at least some rattlesnakes.

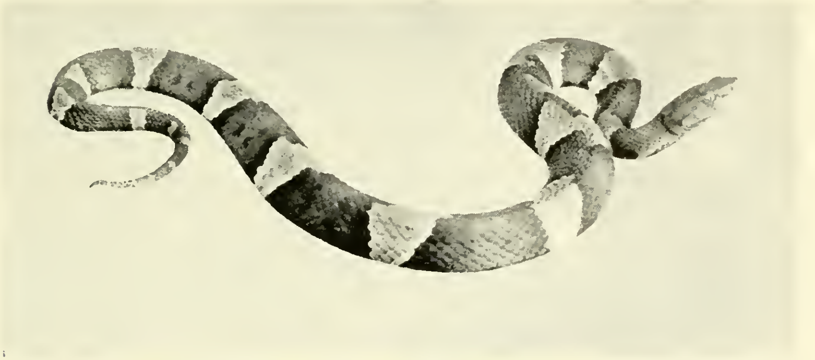


FIG. 235. A copperhead, *Ancistrodon contortrix laticinctus*, approx. × ¼, Boerne, Kendall County, Texas. Photo by H. K. Gloyd.

These are fairly sluggish snakes, seldom attempting to bite unless unduly provoked. The venom is less powerful than that of rattlesnakes, and even that of large specimens is rarely if ever fatal to full-grown persons unless they are in poor health or are in their old age. To small children the venom has been known to be fatal. Serious secondary infections seldom occur after copperhead bites, although they almost always accompany those from rattlesnakes. If permanent damage ever results, almost invariably infections, not venom, are the cause.

Two to ten young measuring about 8½ inches in total length are born in August and September. Mating occurs in April and May.

Kansan Subspecies.—Two races occur in Kansas: *Ancistrodon contortrix mokeson* (Daudin), and *Ancistrodon contortrix laticinctus* Gloyd and Conant. The type locality of the former is Philadelphia, Pennsylvania, and that of the latter is 26 miles northwest of San Antonio, Texas. Two other races are known.

Gloyd and Conant distinguish the two races occurring in Kansas as follows: In *A. c. mokeson*, "dorsal markings of body in the form of dark transverse 'dumb-bells' or 'hourglasses,' considerably narrower on the middorsum than on the sides, and rounded off at the ends, not continuous with the dark markings of the belly." In *A. c. laticinctus*, "dorsal markings consisting of broad, dark cross-bands, not much narrower on the middorsum than on the sides of the belly, and continuous with the dark markings of the belly." Only in Cowley County, in Kansas, do specimens resemble the latter subspecies. The variation occurring in that area indicates that this is an area of intermediacy (intergradation) between the two subspecies. The most recent monographers (Gloyd and Conant) are followed in allocation of the Cowley County specimens.

References.—Conant, 1938: 107-112, pl. 14, fig. 1 (description, natural history, Ohio); Gloyd and Conant, 1943: 150-153, 156, figs. 1, 3, 7, 9 (description, taxonomy, range); McCauley, 1945: 128-135, fig. 34 (description, natural history, Maryland); Gloyd, 1934: 587-604, figs. 1-2, pls. 1-3 (breeding habits, young).

Cottonmouth

Ancistrodon piscivorus (Lacépède)

Crotalus piscivorus Lacépède, Hist. Nat. Serpens, vol. 2, 1789, p. 130 (type locality—Charleston, South Carolina).

Agkistrodon piscivorus Stejneger, Ann. Rept. U. S. Nat. Mus., 1893, p. 406.

Range.—Barely enters southeastern part of state; recorded only from the Neosho River at Chetopa, Labette County.

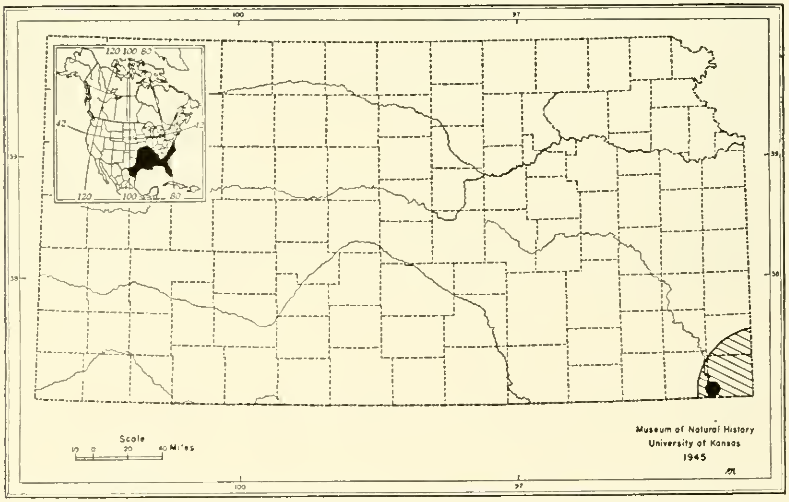


Fig. 236. Distribution of the cottonmouth, *Ancistrodon piscivorus*, in Kansas, with insert showing range of the species.

Description.—Head somewhat flattened, considerably wider than neck; nine large plates on top of head, much as in most colubrid snakes (see Fig. 150); a large pit on side of head between nostril at tip of snout and eye; 2 large preoculars, the upper in contact with nasal scale; no loreal; 3 postoculars; several rows of temporals; supralabials 6-11, generally 8; infralabials 8-13, generally 11; postgenials small or absent. Dorsal scales keeled; generally 27 scale rows on anterior part of body, 25 at middle of body, and 23 immediately in front of anus; anal plate and subcaudals entire, except for a few at tip of tail; ventrals 130-142, average 134; subcaudals 37-49, average 43.

Young specimens with a light gray-brown ground color; 10-16 crossbands on body, much as in copperheads, narrower medially than at sides; each band usually with a somewhat lighter, transverse, central area; belly whitish, becoming black toward anus; under side of tail black. In adults all the dorsal markings become dim as the ground color darkens, so that in large specimens there is usually little or no evidence of the transverse bands. Young specimens with well-defined markings look extraordinarily like copperheads. Tip of tail yellow or greenish yellow in the young.

Size large, the body heavy and the head large, maximum recorded total length 58½ inches; tail about 14 percent of total length.

Recognition Characters.—See discussion of the copperhead.

Habits and Habitat.—This is an almost completely aquatic snake; it is seldom found more than a few hundred feet from water, and usually in the water. It frequents permanent streams in this state, but in parts of its range elsewhere it is found in swamps, marshes, lakes and other permanent bodies of water. The snakes are essentially nocturnal, but emerge from their hiding quarters in the

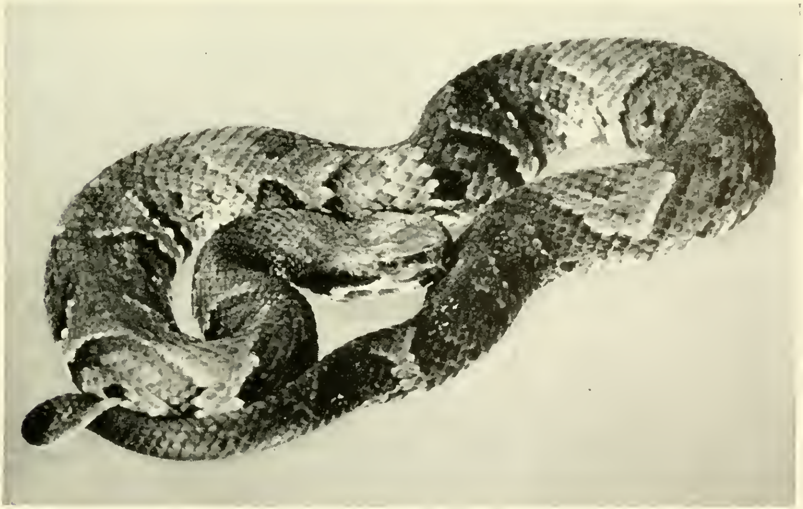


FIG. 237. A cottonmouth, *Ancistrodon piscivorus leucostomus*, × ⅓, Miller County, Missouri. Photo by H. K. Gloyd.

daytime to bask in the sun, outstretched on the limbs of trees, on objects floating in the water, and on promontories at the edge of the water. In general their actions are much like those of the water snakes (*Natrix*) with which the cottonmouth will be forever confused by those who are not well acquainted with both animals.

Unlike the copperhead, cottonmouths are pugnacious; their powerful jaws, long fangs, vicious disposition and potent venom make them a very dangerous animal. The venom is much more powerful than that of the copperhead, and is more nearly comparable to that of the rattlesnake. Any bite from this species is to be considered highly dangerous to life.

The food normally consists of both cold-blooded and warm-blooded vertebrates; frogs, fishes, turtles, small mammals and birds are eaten.

When annoyed these snakes have the habit of drawing the head backward quickly and flicking the jaws wide open, flashing into view the white interior of the mouth. The tail is vibrated as in the copperhead, sometimes producing a sound much like the rattle of a rattlesnake.

Mating occurs in March or April. Males at this and other times indulge in a curious combat. They entwine their bodies and lift the anterior parts straight out of the water several times in succession. The young are born in August and September, in litters of five to fifteen, averaging eight. The young measure approximately ten inches in length when born.

Kansan Subspecies.—Two subspecies are known, one of which, *Ancistrodon piscivorus leucostomus* (Troost), occurs in Kansas. The type locality is 10 miles northeast of Bolivar, Hardeman County, Tennessee. The other subspecies occurs in the extreme southeastern United States.

References.—Gloyd and Conant, 1943: 164-165, figs. 5, 13, 15 (description, taxonomy); Schmidt and Davis, 1941: 285-287, fig. 94, pl. 30 (description, natural history).

Pigmy Rattlesnakes

Genus *Sistrurus* Garman

Massasauga

Sistrurus catenatus (Rafinesque)

Crotalinus catenatus Rafinesque, Amer. Month. Mag. Crit. Rev., vol. 4, 1812, p. 41 (type locality—Kansas City, Missouri).

Sistrurus catenatus Garman, Mem. Mus. Comp. Zoöl., vol. 8, 1883, p. 118, 176, pl. 9, fig. 2.

Range.—Throughout state except northwestern quarter; recorded from as far west as Ford, Russell (5 miles north and 2 miles east of

Gorham), Osborne and Smith (12 miles north of Downs; not mapped) counties.

Description.—A horny rattle or button at end of tail; 9 large plates on top of head, including 2 large plates (parietals) back of eye level, a plate on top of each eye, 1 between the eyes, and 4 in front of eye level; a large pit on each side of head between nostril and eye; on under side of tail most scales entire, not split in the middle; anal scale entire. Dorsal scales usually in 25 rows at middle of body and 19 on posterior part, rather strongly keeled except those in 1 or 2 outermost rows.

Ground color gray-brown; a series of 21 to 50 large, squarish or rectangular dark blotches, usually with fine white borders, on back (excluding tail); blotches about twice as large as spaces between them; belly dark and heavily blotched, or light with numerous, irregular dark blotches.

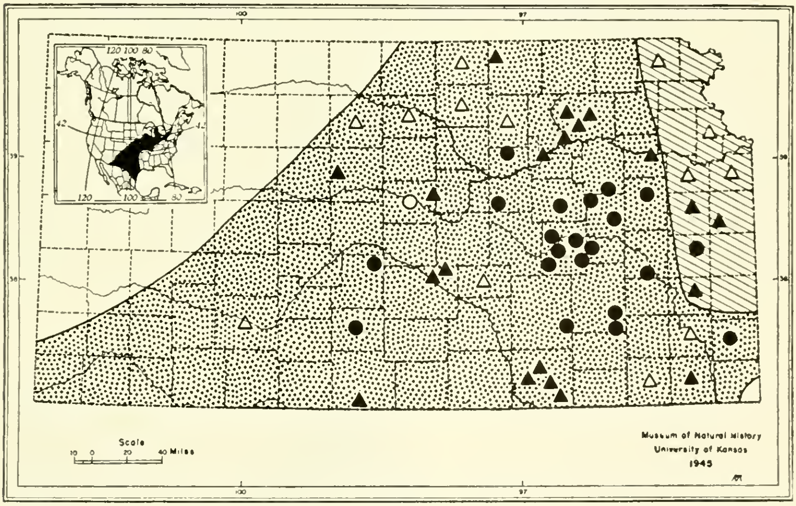


FIG. 238. Distribution of the massasauga, *Sistrurus catenatus*, in Kansas, with insert showing range of the species. The range of *S. c. catenatus* is indicated by the lined area, that of *S. c. tergeminus* by the stippled area.

Usually about two feet long, occasionally slightly exceeding three feet.

Recognition Characters.—No other species of snake definitely known in Kansas has the combination of a rattle on the end of the tail and large plates on top of the head. The western subspecies of ground rattlesnakes (*Sistrurus miliarius streckeri*), which may occur in extreme southeastern Kansas, has this combination, but may be distinguished by the reduction of the scale rows to seventeen on the posterior part of the body and the small size of the dorsal blotches (about half as long as the spaces occurring between them).

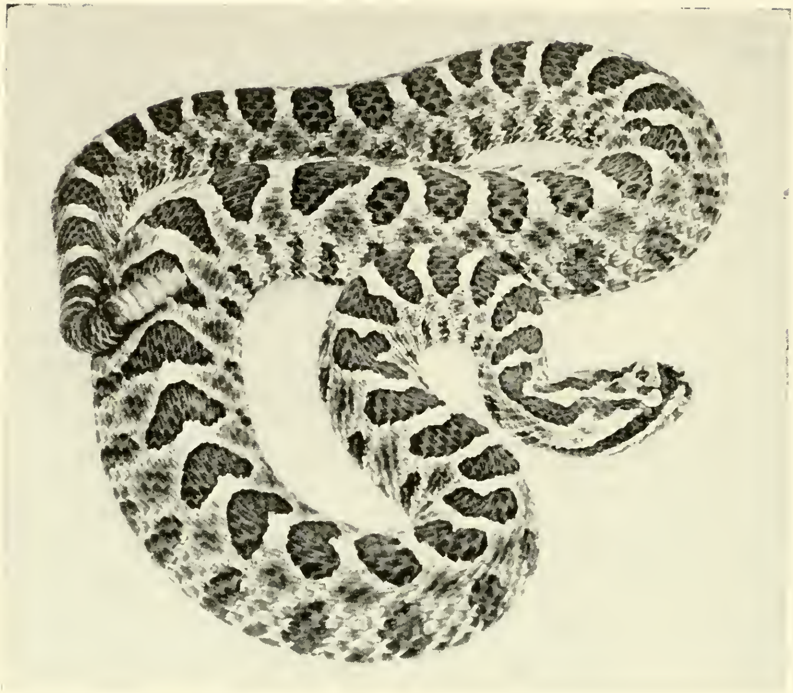


FIG. 239. A massasauga, *Sistrurus catenatus tergeminus*, × ½, Ellsworth, Ellsworth County, Kansas. Photo by H. K. Gloyd.

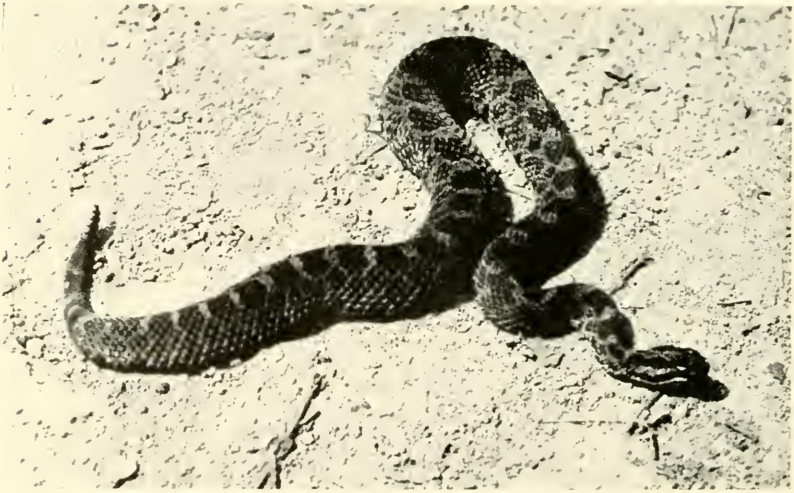


FIG. 240. A massasauga, *Sistrurus c. catenatus*, × ⅓. Courtesy of the New York Zoölogical Society.

Habits and Habitat.—Characteristically found in swampy places except in summer when they may move into drier situations.

Small terrestrial mammals such as mice form most of the food of these snakes. Frogs are sometimes eaten. They are said to swallow the frogs immediately, while the mice are struck and allowed to die in advance.

Young are born in August and September. They number up to 12 and average 8 or 9 per litter. At birth they measure 8 to 9½ inches.

In temperament these snakes are more docile than most other rattlesnakes. They will strike when sufficiently annoyed, however, and the venom is known to be extremely toxic although only two deaths of human beings, caused by the bite of this species, have been recorded.

Kansan Subspecies.—Two subspecies occur in Kansas: The Eastern Massasauga, *Sistrurus catenatus catenatus* (Rafinesque), and the Western Massasauga, *Sistrurus catenatus tergeminus* (Say), with type locality at Winfield, Cowley County, Kansas. No other subspecies are recognized anywhere in the entire range of the species. The first-mentioned occurs as far west as Franklin (Ottawa) and Anderson (Garnett) counties, and as far south as Allen County (4 miles west of Moran). Westward and southward of these localities S. *c. tergeminus* occurs. The type locality of the latter is not known.

The two subspecies differ as follows:

catenatus	*tergeminus*
1. Belly dark.	1. Belly relatively light.
2. Ventrals average 137 (range 129-150) in males, 142 (range 136-151) in females.	2. Ventrals average 147 (range 140-154) in males, 152 (range 148-158) in females.
3. Dorsal blotches usually fewer than 36, average 32 (range 21-40) in males, 33 (range 24-39) in females	3. Dorsal blotches usually more than 36, average 38 (range 28-45) in males, 40 (range 30-50) in females.

Reference.—Gloyd, 1940: 36-55, maps 1-2, pls. 2-3 (complete description, locality records, range, variation).

True Rattlesnakes

Genus *Crotalus* Linnaeus

Western Diamond-backed Rattlesnake

Crotalus atrox Baird and Girard

Crotalus atrox Baird and Girard, Cat. N. Amer. Rept., 1853, p. 5 (type locality—Indianola, Calhoun County, Texas).

Range.—Extreme southern Kansas. Recorded definitely only from a locality six miles west of Pittsburg, Crawford County, and one mile north of Weir, Cherokee County, Kansas. Residents of Barber, Clark and Comanche counties report its occurrence in that region, and specimens have been taken immediately south of that area near Freedom, Woods County, Oklahoma.

Description.—A horny button or rattle at end of tail; scales on top of head numerous, small; deep pit on each side of head between eye and nostril; ventrals 170 to 196; caudals 16 to 31, for the most part undivided; anal plate entire; dorsal scales in 25 or 27 rows at middle of body, rather strongly keeled except those in the 1 or 2 outermost rows.

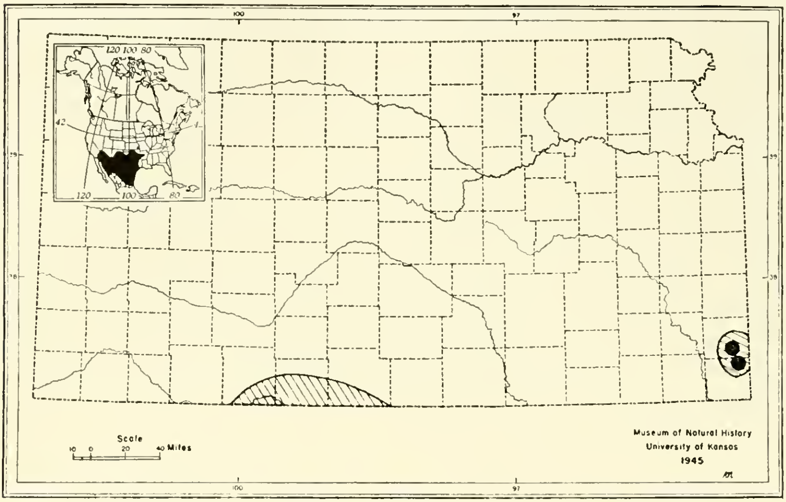


FIG. 241. Distribution of the western diamond-backed rattlesnake, *Crotalus atrox*, in Kansas, with insert showing range of the species.

Ground color gray, gray-brown, or buff; 25 to 45 rhomboidal or diamond-shaped blotches on body (excluding tail); blotches light-edged and sometimes with a dark border inside the light line; tail with prominent, alternating white and black rings, all sharply contrasting with color of body; a light diagonal stripe back of eye, and sometimes another in front of eye.

Frequently up to about 4½ feet in total length, sometimes exceeding 7 feet.

Recognition Characters.—There are three species of snakes in Kansas which possess the combination of small scales on the head and a rattle on the tail. This species can be distinguished from the other two by the combination of rhombic blotches and a tail marked with white and black rings. The prairie rattlesnake has somewhat

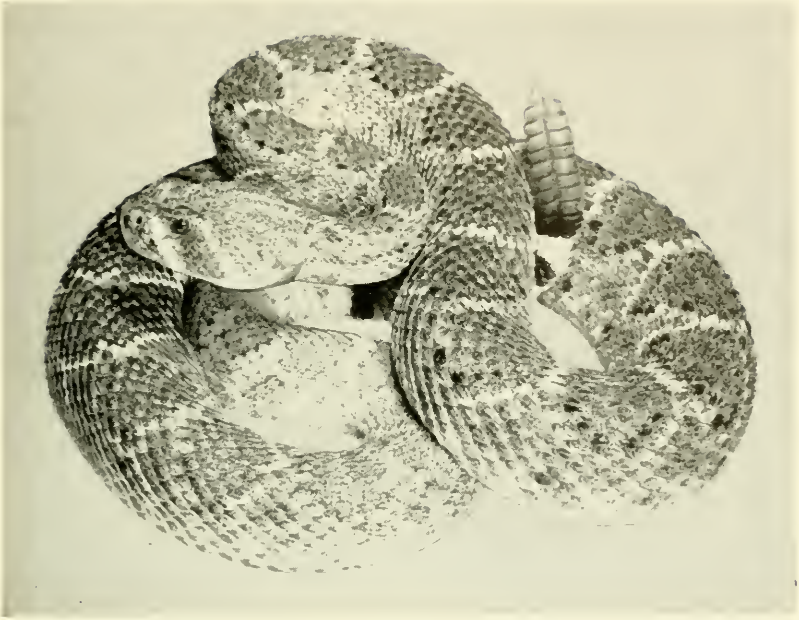


FIG. 242. A western diamond-backed rattlesnake, *Crotalus atrox*, × ⅖, Cache, Oklahoma. Photo by H. K. Gloyd.

similar blotches, but its tail is marked much like the rear part of its body, and the pattern of the tail thus does not contrast sharply with the pattern of the body. The timber rattlesnake has chevron-shaped blotches at least on the forepart of the body, 23 scale rows at the middle of the body (the others have 25 or 27) and the tail is black in most adults (ringed in the young).

Habits and Habitat.—This species prefers relatively dry plains, canyons and hills, where vegetation is sparse or low.

The food consists chiefly of small terrestrial mammals such as rats, mice, and small rabbits. Birds are eaten occasionally.

Mating occurs in early spring, and the young are born in the fall or late summer. Litters may include as many as twenty, but usually number around ten. At birth the young measure about a foot in length.

Kansan Subspecies.—No subspecies are recognized at the present time anywhere in the range of this species.

Reference.—Gloyd, 1940: 204-206, map 16, pl. 20, fig. 2 (range, diagnosis, synonymy).

Timber Rattlesnake

Crotalus horridus Linnaeus

Crotalus horridus Linnaeus, Syst. Nat., ed. 10, vol. 1, p. 214 (type locality—New York, New York).

Range.—Northeastern sixth of state, and extreme eastern border southward to Oklahoma; recorded as far west as Elk (3 miles east of Elk Falls), Bourbon (Xenia), Anderson, Linn (Mound City), Franklin (Ottawa), Osage (5 miles northeast of Carbondale), Wabaunsee, Geary (15 miles southeast of Junction City), Riley (Manhattan), and Marshall (Irving) counties.

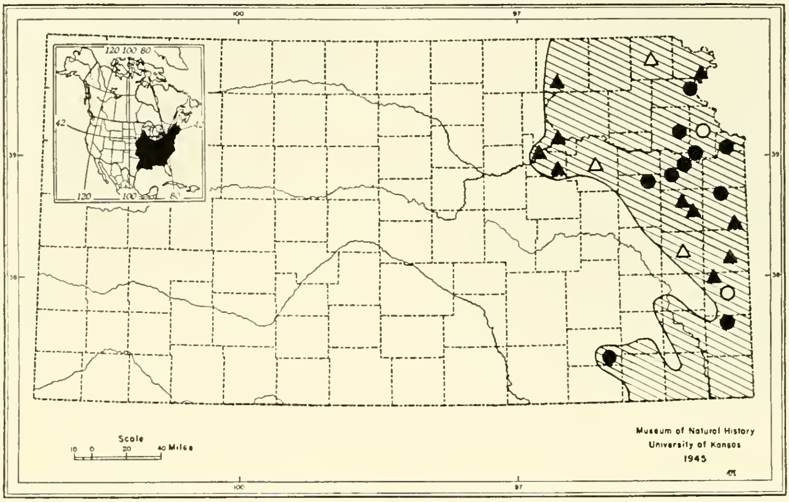


FIG. 243. Distribution of the timber rattlesnake, *Crotalus horridus*, in Kansas, with insert showing range of the species.

Description.—Horny button or rattle at end of tail; scales on top of head numerous, small; deep pit on each side of head between eye and nostril; ventrals 158 to 177, caudals 17 to 25, scale rows at middle of body 23, in subspecies occurring in Kansas; caudals mostly undivided; anal plate entire; dorsal scales rather strongly keeled except those in outer rows.

Ground color variable, light to dark gray; 18 to 33 dark blotches on body (excluding tail); blotches in the form of narrow, angular crossbands at least on forepart of body; tail usually black in adults and subadults, no alternating dark and light rings clearly evident.

Commonly reaches length of 3½ feet; maximum recorded length 6 feet 2 inches.

Recognition Characters.—See discussion of the western diamond-backed rattlesnake.

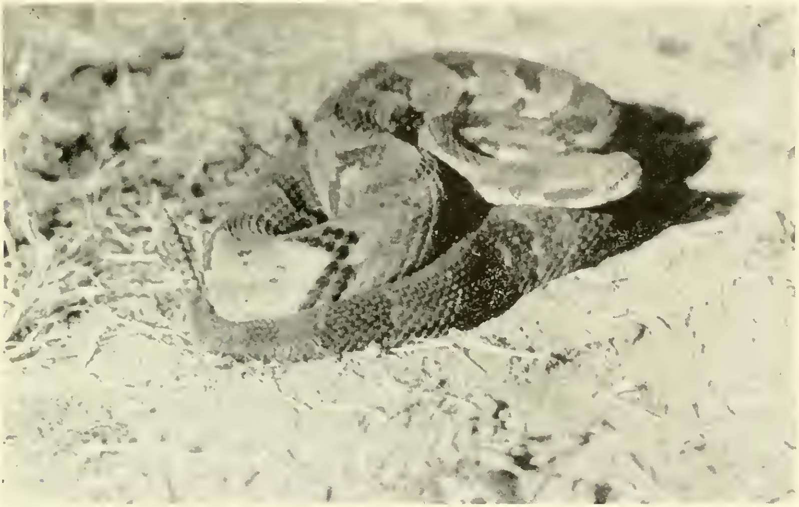


FIG. 244. A timber rattlesnake, *Crotalus h. horridus*, × ⅓, 7 miles southeast of Ottawa, Franklin County, Kansas. Photo by H. K. Gloyd.

Habits and Habitat.—This species is usually found, at least in Kansas, in wooded hills where there is a limestone outcrop. In summer they probably wander away from the hills into adjacent open valleys and plains, but no observations on their activity at different times of the year have been recorded.

The food consists chiefly of small mammals. An analysis of 141 Virginia snakes reveals that 38 percent contained mice, 18 percent rabbits, 5 percent shrews, and 13 percent birds.

Kansan Subspecies.—Only one, *Crotalus horridus horridus* Linnaeus, occurs in the state. Only one other subspecies is recognized; it occurs in the southern half of the eastern United States and is known as the Canebrake rattlesnake (*Crotalus horridus atricaudatus* Latreille).

Reference.—Gloyd, 1940: 168-184, map 12, pl. 12, fig. 2, pl. 13, fig. 1 (synonymy, description, distribution, locality records, variation, phylogeny).

Prairie Rattlesnake

Crotalus viridis (Rafinesque)

Crotalinús viridis Rafinesque, Amer. Month. Mag. and Crit. Rev., vol. 4, p. 41 (type locality—Pierre, South Dakota).

Crotalus viridis Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, 1936, pp. 194, 241, figs. 50, 52, 68, 85.

Range.—State-wide except in northeastern quarter of state. Recorded from as far east as Crawford County (Pittsburg) and Riley County (Manhattan). Rare east of Republic and Barber counties.

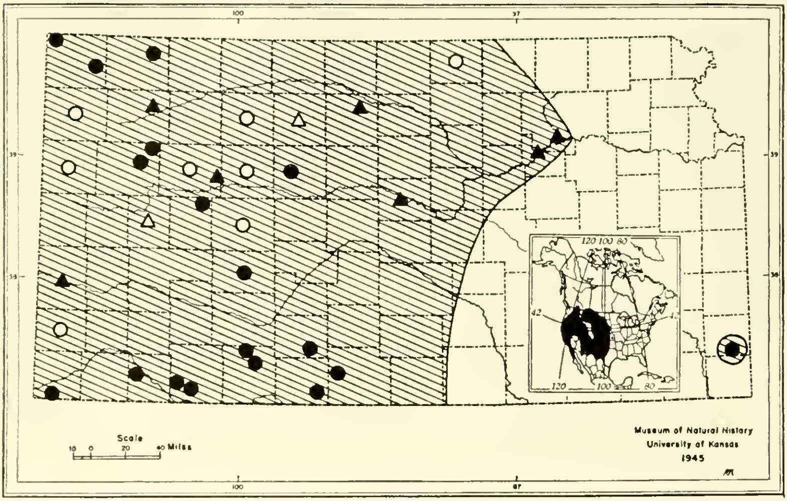


FIG. 245. Distribution of the prairie rattlesnake, *Crotalus viridis*, in Kansas, with insert showing range of the species.

Description.—A horny button or rattle at end of tail; scales on top of head numerous, small; deep pit on each side of head between eye and nostril; ventrals 164 to 196; caudals 14 to 31, mostly undivided; anal plate entire; dorsal scales in 25 or 27 rows at middle of body, rather strongly keeled except the outer rows.

Ground color greenish gray or greenish brown; 33 to 55 oval, usually white-edged, dark blotches on body (excluding tail); posterior blotches becoming crossbands; ground color of tail like that of body; rings on tail similar in color to those on rear part of body, gradually becoming darker toward tip, so that the last 1 or 2 may be black; sides of head dark, with two diagonal white lines; 1 or 2 fine transverse white lines on each side of top of the head, over the eyes.

Commonly reaches a total length of three feet, and has been recorded up to five feet.

Recognition Characters.—See discussion of the western diamond-backed rattlesnake.

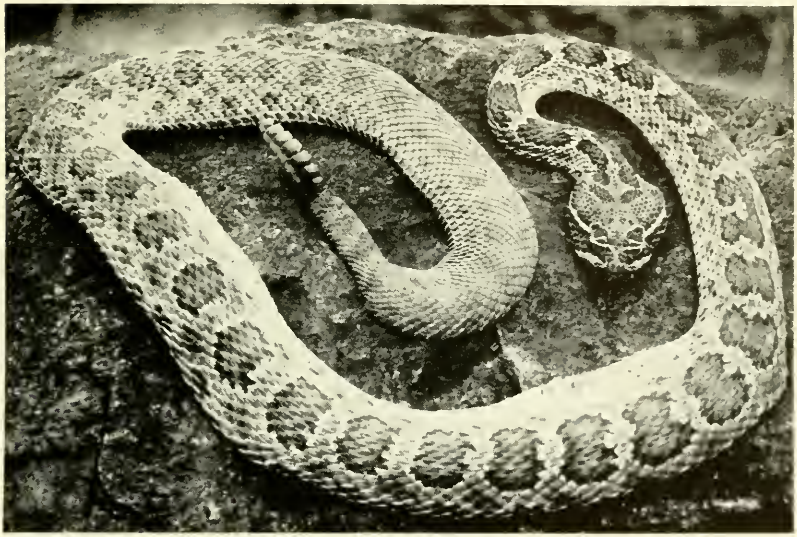


FIG. 246. A prairie rattlesnake, *Crotalus v. viridis*, × ⅓. Courtesy of the New York Zoölogical Society.

Habits and Habitat.—Commonly found in prairies, prairie canyons, and other grasslands. Overwinters in underground cavities, as in rocky hills, caves, and large holes. The species is said to be active mostly in the daytime.

The food consists primarily of small mammals such as rats, mice, gophers and young prairie dogs.

Litters of young are born every other year (for any one female); and the number per litter varies from 4 to 21, and averages 12.

Kansan Subspecies.—Only one, *Crotalus viridis viridis* (Rafinesque), occurs in the state. Seven other subspecies are commonly recognized from the Rockies westward.

Reference.—Gloyd, 1940: 212-213, map 17, pl. 22 (range, diagnosis, synonymy).

SPECIES AND SUBSPECIES OF PROBABLE BUT UNVERIFIED OCCURRENCE

The following list includes kinds of reptiles and amphibians which have not yet been certainly recorded from Kansas but the occurrence of which in Kansas is indicated by the distributional data from adjoining areas. Probably still other kinds exist within the state. Nevertheless, the list may include most of the kinds which remain to be found and can serve as a guide to the areas in which it will be most profitable to look for them.

MARBLED SALAMANDER

Ambystoma opacum (Gravenhorst)

The marbled salamander probably occurs in extreme southeastern Kansas. It is a terrestrial species which is widely distributed in the eastern and southern United States.

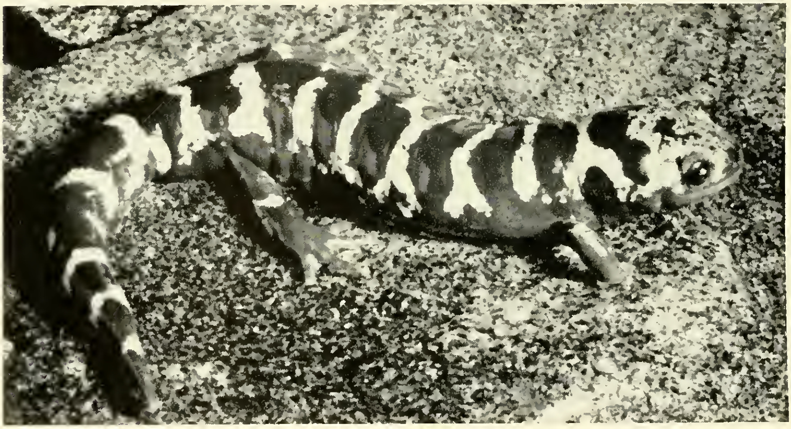


FIG. 247. A marbled salamander, *Ambystoma opacum*, approx. × 1, 5 miles south of Church Creek, Dorchester County, Maryland. Courtesy of the Zoölogical Society of Philadelphia.

OZARK BLIND SALAMANDER

Typhlotriton spelaeus Stejneger

This species is known from southwestern Missouri, northwestern Arkansas and northeastern Oklahoma. If a suitable habitat occurs in extreme southeastern Kansas—a cave with constantly running water—this species almost certainly will be found in it. See Fig. 23a.

HAMMOND SPADEFOOT

Spea hammondii (Baird)

The Hammond Spadefoot has been recorded from two northern counties in Oklahoma (Woods and Cimarron). If these records are correct the species probably occurs also in Kansas, in adjacent areas.

HURTER SPADEFOOT

Scaphiopus hurterii Strecker

The Hurter Spadefoot has been recorded from northern Oklahoma in Osage and Cimarron counties, and almost certainly occurs in Kansas along the Arkansas and Cimarron rivers.

WOOD FROG

Rana sylvatica sylvatica Le Conte

Probably the Wood Frog is a resident of extreme southeastern Kansas. It has been recorded from Washington County in northwestern Arkansas and Stone County in southwestern Missouri.

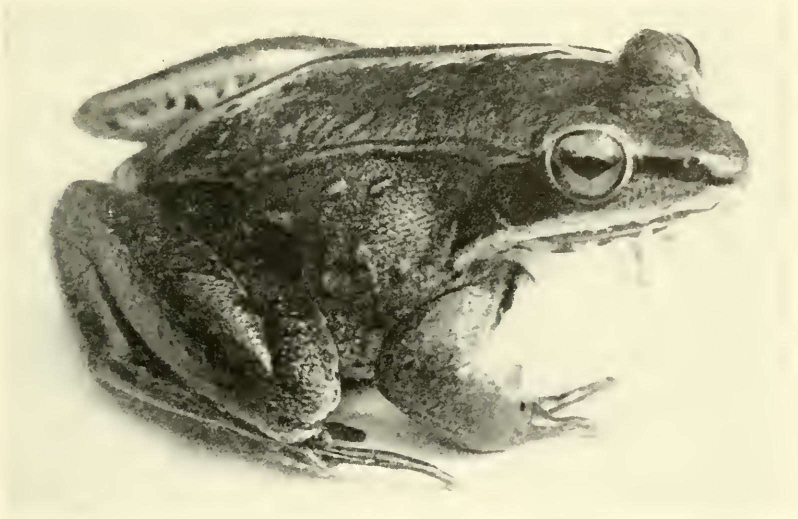


FIG. 248. A wood frog, *Rana s. sylvatica*, × 1¼. Courtesy of the New York Zoölogical Society.

COMMON MUD TURTLE

Kinosternon subrubrum hippocrepis Gray

The record of this species from Kansas City, Missouri (Anderson, 1942, p. 211), and other records for northeastern Oklahoma and southwestern Missouri, indicate a strong probability that *K. subrubrum* occurs in extreme eastern Kansas. Specimens may easily be confused with *Sternotherus odoratus*, which has similar markings on the sides of the head. The size of the plastron differs markedly, however, as in other species of the two genera.

MANY-LINED SKINK

Eumeces multivirgatus (Hallowell)

No authentic records of this species in Kansas are known. Taylor (1935:351) cites three unacceptable records, for Woodson (Cragin, 1881), Anderson (Burt,

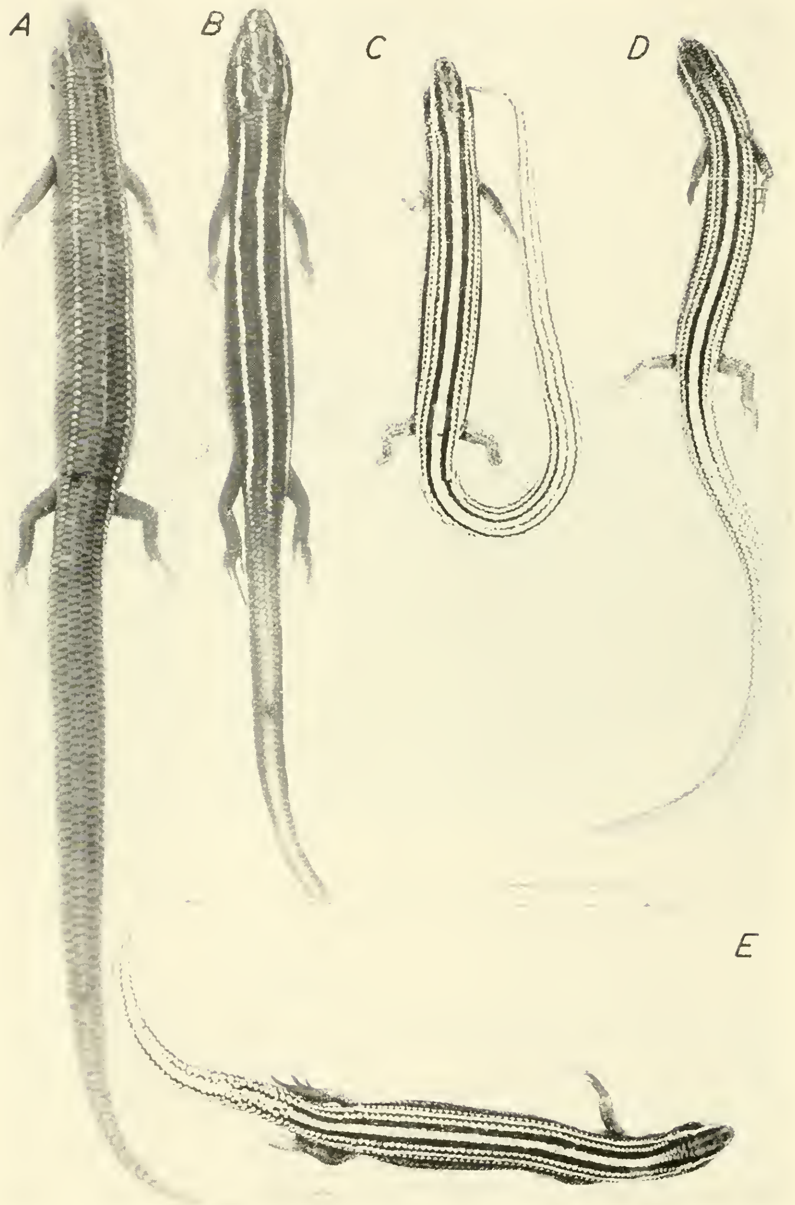


FIG. 249. Many-lined skinks, *Eumeces multivirgatus*. A. Chihuahua, Chihuahua, Mexico, × 1½. B. Grand Canyon National Park, Arizona, × 1½. C, D, E, Weld County, Colorado, × 1. From Smith (1946). Photos by E. H. Taylor.

1928) and Labette (Burt, 1928) counties. These are unquestionably incorrect, through either misidentification or erroneous locality data. Well authenticated records are from northern, central and western Nebraska and eastern Wyoming southward through Colorado and New Mexico; the species accordingly possibly occurs in northwestern Kansas, although the preferred habitat (arid high plains) of the species does not enter the state. The eastern limit of range of the species seems closely to correspond with that of *Phrynosoma douglassii* (see p. 184; Richard B. Loomis, personal communication).

BLANDING TURTLE

Emys blandingii (Holbrook)

The Blanding Turtle should be looked for in tributaries of the Missouri and Kansas (Kaw) rivers in north-central and northeastern Kansas. In Nebraska it has been recorded from as far south as Kearney in Buffalo County.

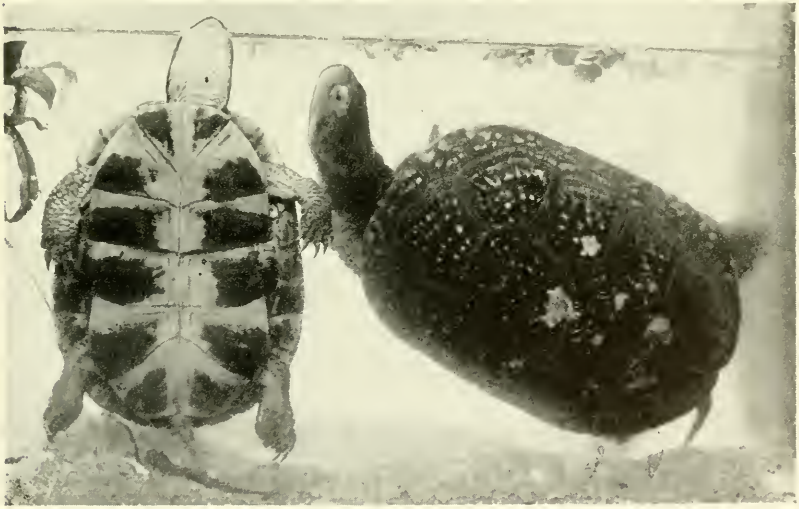


FIG. 250. Blanding turtles, *Emys blandingii*, × 1/3. Courtesy of the New York Zoölogical Society.

FOX SNAKE

Elaphe vulpina vulpina (Baird and Girard)

The Fox Snake probably occurs in northeastern Kansas. It is known throughout eastern Nebraska, and from as near Kansas as Nemaha County, Nebraska. Cragin believed that he had collected the species in Kansas, but no identifiable material was preserved (Branson, 1904:390).

BASIN GARTER SNAKE

Thamnophis elegans vagrans (Baird and Girard)

This garter snake probably occurs in extreme western Kansas. It has been recorded from northwestern Nebraska (Sioux Co.) and northwestern Oklahoma (Cimarron Co.). It should be looked for in Kansas along streams such as the Cimarron, Arkansas, Smoky Hill and Republican rivers, all of which head in Colorado and New Mexico. Cragin notes a specimen from "Kansas" in the Museum of Comparative Zoölogy, and another from "Ft. Riley" where the species undoubtedly does not occur (see Taylor, 1929:61).

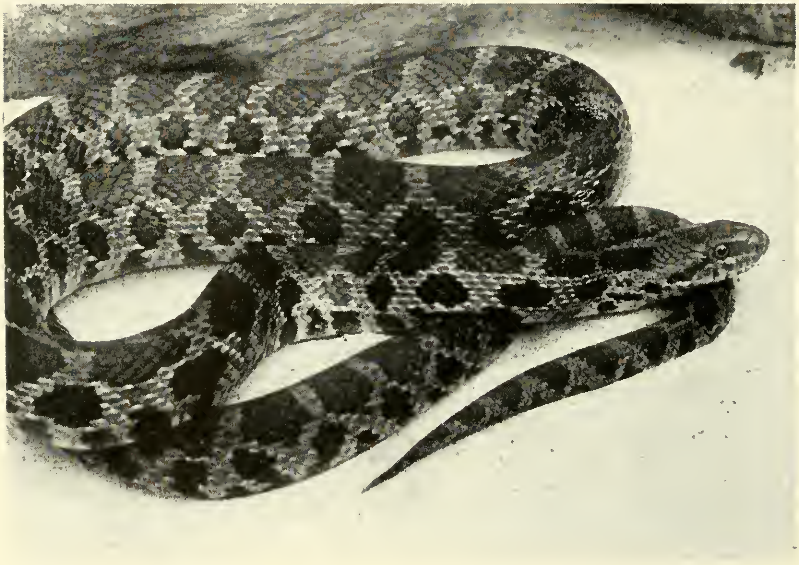


FIG. 251. A fox snake, *Elaphe v. vulpina*, × ½. Courtesy of the New York Zoölogical Society.

PIGMY RATTLESNAKE

Sistrurus miliarius streckeri Gloyd

Possibly this snake occurs in extreme southeastern Kansas; it has been recorded from southwestern Missouri, northwestern Arkansas and northeastern Oklahoma, and should be sought near water in adjacent areas of Kansas.

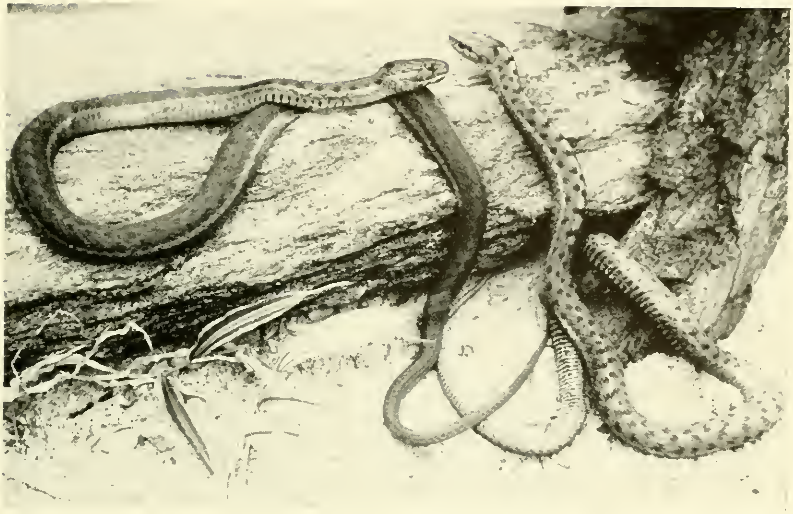


FIG. 252. Basin garter snakes, *Thamnophis elegans vagrans*, × ⅖. Courtesy of the New York Zoölogical Society.

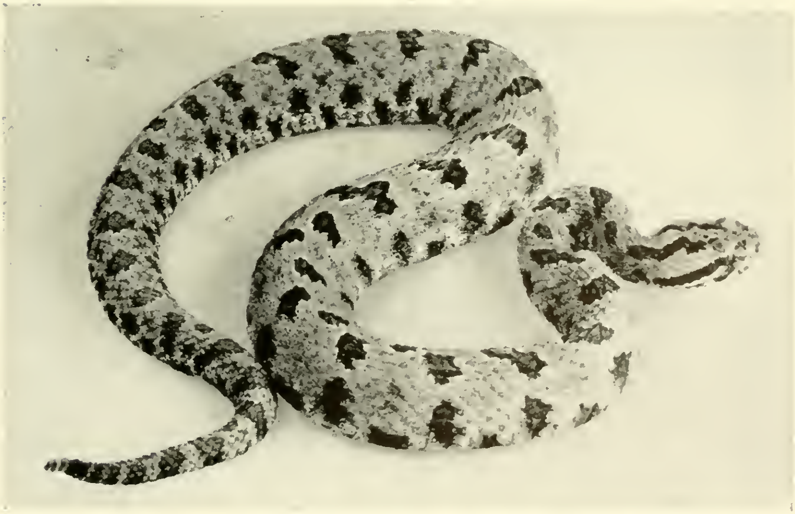


FIG. 253. A pigmy rattlesnake, *Sistrurus miliarius streckeri*, approx. × ⅔, Imboden, Lawrence County, Arkansas. Photo by H. K. Gloyd.

GLOSSARY

abdomen—the belly.

abdominal—pertaining to the belly; in turtles, the scutes preceding the femoral scutes which are in broadest contact with the bridge, the third set in front of the rear margin of the plastron.

adpressed—in reference to the limbs, laid full length against the sides of the body, with the hind legs pointing anteriorly and the forelegs pointing posteriorly.

anal—of or pertaining to the anus; in snakes, the scale covering the anus; in turtles, the scutes or pair of scutes at the rear of the plastron.

antepenultimate—the third in a series, counting from the end.

anterior—pertaining to, designating, or situated near or toward, the head.

anurans—the order of tailless amphibians; popularly, the frogs and toads.

anus—the posterior opening of the digestive tract.

areolae—a small open space; in patterns, small unpigmented areas.

boss—a rounded protuberance, as on top of the head between the eyes in certain toads.

bridge—in turtles, a narrow connection at sides of the belly between the ventral part of the shell (plastron) and the dorsal part (carapace).

carapace—in turtles, the dorsal part of the shell.

chinshields—in lizards, a paired series of enlarged scales diverging posteriorly from the mental or postmental scale; in snakes, one or two median pairs of elongate scales on the ventral surface of the head, posterior to the mental or to the first infralabial scales which may be in contact on the midventral line.

corneous—of a surface texture resembling that of horn; toughened, in reference to epidermal tissue.

costal—pertaining to the sides of the thoracic region or to the ribs; in turtles, one of the plates between the series of median (vertebral) and lateral (marginal) plates.

costal groove—in salamanders, a vertical groove on the side of the body between the limbs or positions of the limbs.

cranial crests—crests or ridges on the top and sides of the head.

cruciform—as applied to reptiles and amphibians, X-shaped.

dewlap—a vertical, longitudinal, loose flap of skin on the throat, as in anoles.

dextral—of or pertaining to the right, not left.

digit—one of the fingers or toes.

distal—designating that end of a limb or other part which is farthest from the point of attachment.

dorsal—situated on or pertaining to the back or upper surface, as applied to reptiles and amphibians.

dorsals—the dorsal scales, counted in a straight line in lizards from the rear of the head, immediately back of the interparietal, to a point even with the rear margin of the hind legs as the latter are held at right angles to the body; in snakes, the scales on the sides as well as the back, including all on the body except the single row of enlarged ventral scales.

dorsolateral folds—folds or in reality ridges extending posteriorly along the sides of the back.

envelope—applied to the surface of any one of possibly several layers of gelatinous material around amphibian eggs.

facial pit—a deep pit on the side of the head between the nostril and eyes.

femoral—of or pertaining to the proximal part of the leg (thigh); in turtles, the scutes of the plastron immediately preceding the rear plates.

femoral pores—in certain lizards, a series of pores on the under side of the thigh.

frontal—in snakes and lizards, the plate on the middle of the upper surface of head between the eyes.

frontonasal—in lizards, the plate or plates immediately preceding the prefrontals.

frontoparietals—in lizards, the scales between the parietals and frontal.

gills—organs for respiration under water; in amphibians, restricted to pharyngeal (neck) region; in salamanders, fluffy structures on the sides of the neck.

gill slits—clefts or holes on the sides of the neck of salamanders, situated at the bases of the gills (gills absent in the hellbender).

groin—the area on the body anterior to the bases of the hind legs.

gular—pertaining to the ventral surface of the neck (throat); in turtles, a scute or pair of scutes preceding the pectoral plates.

gular fold—in lizards, a transverse belt of tiny granules, bordered by or often overlapped from the front by larger scales across the throat, immediately in front of the forelegs; in salamanders, a groove in the skin at the same position.

humeral—a scute or pair of scutes on the plastron (ventral portion of the shell) of hard-shelled turtles; the second pair in front of the bridge.

immaculate—unspotted, unpigmented.

infralabials—the scales on the lower jaw bordering the lower lip.

inner metatarsal tubercle—a protuberance on the under side of the heel opposite the first toe.

internasals—one or two pairs of scales on the median dorsal surface of the snout between the nasals.

interoccipital—one or several small scales in a middorsal area at rear of head immediately back of the interparietal.

interparietal—in lizards, a median scale posterior to the frontal on the dorsal surface of the head; in or below it the parietal "eye" occurs.

keel—an elevated, longitudinal, straight ridge, either sharp and well defined or broad and obtuse.

labium—lip; in tadpoles the upper or lower part of the disk surrounding the beak which guards the opening of the mouth.

lamellae—in lizards, the transverse plates on the under sides of the digits.

lamina—large, thin, horny plates on the surface of the shell in most kinds of turtles.

lateral—situated on or pertaining to the right or left sides.

lateral intercalary scales—in skinks, the row of scales wedged at the base of a digit between the two series of plates covering the upper and the lower surfaces of a digit.

loreal—pertaining to the region between the eye and naris on the side of the head; the scale or scales immediately above the supralabials between the preocular and the nasal or postnasal(s); in snakes, if only one lateral scale is present between the eye and the nasal, that lateral scale may be regarded as a loreal if longer than wide (high), but that scale is to be regarded as a preocular if wider than long.

lower labials—the plates on the lower jaw bordering the lower lip.

mandible—a jaw, usually used in reference to a movable jaw, therefore usually the lower jaw only (both jaws in tadpoles).

marginals—in turtles, the scutes bordering the upper part (carapace) of the shell.

median—situated in the middle.

metatarsal tubercle—a tubercle or projection on the ventral surface of the heel.

metatarsus—the basal portion of the foot, from the heel to the base of the digits.

mouth-disk—a more or less flattened (when spread) disk surrounding the mouth of a tadpole.

nares—the nostrils; *naris* the singular form.

nasal—of or pertaining to the nostrils or the passages into which they lead; the scale through which the nostril is pierced.

nuchal—situated on or pertaining to the dorsal or lateral surface of the neck; in some lizards, restricted to the enlarged scales immediately posterior to the head; in turtles, the median anterior scute of the margin of the carapace (dorsal part of the shell).

occipital—of or pertaining to the occiput, or in horned lizards, to the pair of spines on either side of the middorsal rear point of the head.

occiput—the rear part of the head.

ocular—situated on or pertaining to the lateral surface of the orbit; in the blind snakes, applied to the large scale situated immediately over the eyeball (which may be detected as a small dark spot below the surface in the orbital region).

orbit—the space in which the eyeball is situated.

outer metatarsal tubercle—a projection or protuberance on the ventral surface of the heel opposite the fifth toe.

papillary fringe—a fringe of papillae (minute fingerlike projections), as around portions of the edge of a mouth-disk.

parietals—a pair of scales near the rear of the head; in snakes, they are in contact with each other, are situated immediately posterior to the frontal and supraocular, and form the rear margin of the plated portion of the head; in lizards, they are on either side of the interparietal and usually posterior to the frontoparietal.

parotoid gland—in toads, a gland, appearing as a swollen area, on either side of the neck above the level of the tympanum.

pectoral—pertaining to the chest and to a forelimb or its girdle; in turtles, a pair of scutes on the plastron immediately preceding the abdominal scutes which lie opposite (or in snapping turtles form a part of) the bridge.

penultimate—the last but one.

phalanges—bones or cartilages in the fingers or toes.

pit, facial—a deep pit on the side of the head between the nostril and eye.

plastron—the ventral part of the shell of a turtle.

plinth—a flattened mass, oval or round.

postanals—in lizards, a pair of large scales, surrounded by small scales, near the midventral line a short distance posterior to the anus.

posterior—at or toward the hinder end of the body;—opposed to anterior.

postgenial—in lizards, the rear scale in the series of chinshields; in snakes, the rear chinshield.

postlabials—scales posterior to and in series with either the supralabials or the infralabials.

postmental—a median, unpaired scale (rarely paired) or series of scales posterior to the mental.

postnasal—in lizards, a scale, sometimes paired, immediately posterior to the nasal.

postorbital crest—in toads, a bony ridge (one of the cranial crests) extending transversely immediately posterior to the orbit.

postocular(s)—one or more enlarged scales bordering the orbit posteriorly.

prefrontal(s)—one or more scales immediately preceding the frontal, between the anterior margins of the orbits.

pregenials—in snakes, the anterior pair of chinshields.

preocular(s)—one or more enlarged scales bordering the orbit anteriorly.

proximal—designating that end of a limb or other part which is nearest to the point of attachment.

reticulation—a network of lines which cross irregularly and form meshes.

rostral—a scale forming the tip of the snout.

rugosity—a wrinkle or corrugation, or the state or property of being rugose, corrugated or wrinkled.

scale rows—the longitudinal rows of scales on the back and sides; counted in snakes crosswise on the body from one side of the enlarged ventrals to the other side (see Fig. 150); when unspecified, a scale row number in snakes is the number at midbody.

scute—a large scale.

serrate—notched on the edge like a saw.

shank—the part of the leg between the knee and ankle.

sinistral—on or pertaining to the left side.

spiracle—an opening into a gill pouch or chamber, when only one opening is present on a side.

subarticular—below an articulation (joint).

subcaudal—on the ventral surface of the tail; in snakes, the single or paired row of scales on the ventral surface of the tail.

subequal—approximately equal or alike.

supralabials—scales of the upper jaw bordering the upper lip, except that scale situated at the median anterior point at the tip of the snout.

supramarginals—the small scales (in the alligator snapper only) between the marginal scutes and the costal scutes.

supranasals—scales bordering the nasal scale above (medially), and lateral to the internasals.

supraoculars—scales lying directly above the orbit.

temporal(s)—on or pertaining to the sides of the head behind the orbits; in snakes and lizards, the scales of that area.

- *primary*—the anterior temporal(s).
- *secondary*—the second row (transverse) of temporals, immediately posterior to the anterior row.

thigh—the part of the leg between the knee and the body.

truncate—blunt, as if cut off; not tapering.

tubercle—a small, often somewhat blister-shaped, projection.

tympanum—the ear drum.

upper labials—the scales of the upper jaw bordering the upper lip except the scale at the median anterior point at the tip of the snout.

vent—anus; the opening at the rear end of the digestive tract.

ventral—on or pertaining to the ventral surface; in snakes, one scute of the series of the scutes on the belly.

vertebral—on or pertaining to the middorsal line; in turtles, the scutes on the middorsal line exclusive of the nuchal.

vitelline membrane—the fine membrane, usually not visible, surrounding and in contact with the vitellus.

vitellus—the egg itself, including the yolk but excluding the enveloping membranes.

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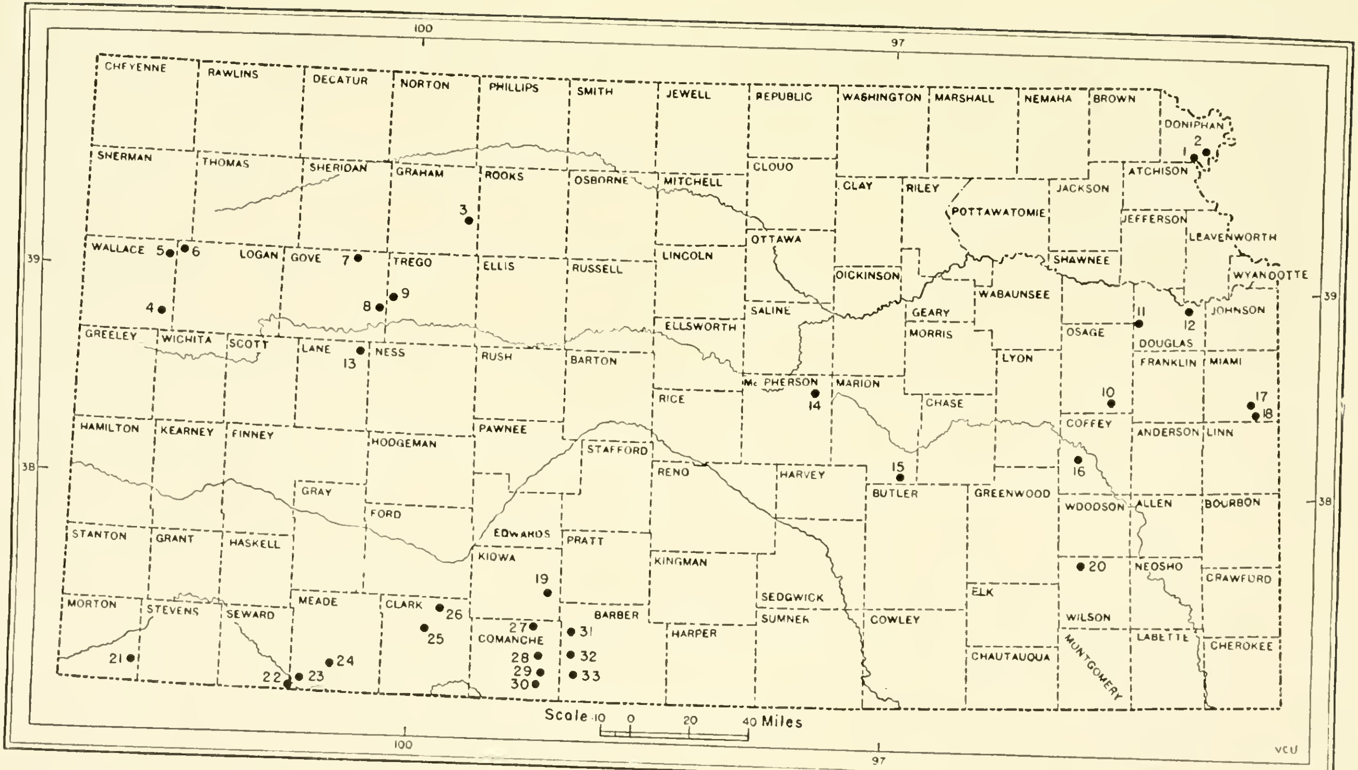
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FIG. 232. Map of Kansas with (a) place names rarely shown on maps, and (b) names of counties:

1. Geary Lake
2. Doniphan Lake
3. Wild Horse
4. Lacey Ranch
5. Rhino Hill Quarry and Marshall Ranch
6. Vincent Ranch
7. Buffalo Park
8. Castle Rock
9. Banner
10. Long Creek Camp
11. Twin Mounds
12. Horseshoe Lake
13. King Ranch
14. Battle Hill
15. Walnut River Camp
16. Otter Creek Camp
17. Pigeon Lake
18. Murray Lake
19. Rezeau Ranch
20. Big Sandy Creek Camp
21. Rolla
22. Wolf Canyon
23. Keefe Canyon
24. Rexroad Ranch and State Lake
25. Ravenscroft Pasture
26. Stephenson Ranch
27. Robbin's Pasture
28. Indian Creek Camp
29. Arrington
30. Schwartz Canyon
31. Havard Cave
32. Deerhead
33. Sunnyside School House

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3. In Memoriam, Charles Dean Bunker, 1870-1948. By E. Raymond Hall. Pp. 1-11, 1 figure in text. December 15, 1951.

4. The University of Kansas, Natural History Reservation. By Henry S. Fitch. Pp. 1-38, 4 plates, 3 figures in text. February 20, 1952.

5. Prairie Chickens of Kansas. By Maurice F. Baker. Pp. 1-68, 4 plates, 15 figures in text. March 10, 1953.

6. The Barren Ground Caribou of Keewatin. By Francis Harper. Pp. 1-140, 28 figs. October 21, 1955. Copies, paper bound, $1.50 postpaid from The Arctic Institute of North America, 1530 P Street NW, Washington, D.C.

7. Handbook of Mammals of Kansas. By E. Raymond Hall. Pp. 1-303, illustrated. December 13, 1955. Paper bound, $1.50 postpaid (cloth $4.00).

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